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Electricity and Gas.

LAST week the annual meeting of the Institution of Gas Engineers was held at the Institution of Civil Engineers, Westminster. It was noteworthy, from our point of view, for the strong indications it furnished of a desire on the part of many of the members for a *rapprochement* between gas and electricity supply undertakings. A remark of Mr. A. W. Sumner that the gas industry took no exception to the Government's electricity development scheme, provided that the gas industry was not unfairly dealt with, was received with applause. At luncheon, Sir Charles Morgan, a past-president of the Institution of Civil Engineers, advocated the merging of the interests of the rival undertakings, and Mr. C. P. Sparks, in a later speech, urged gas and electricity suppliers to get to know each other better.

Whilst these are the most recent references to the subject, they are by no means isolated. A few weeks ago the *Gas World* cordially welcomed the steps that had been taken by the Institution of Electrical Engineers and the National Gas Council to investigate the possibilities of closer co-operation "in promoting capital and fuel economy in the supply of energy derived from coal and other fuels" by the formation of a Joint Committee some months ago (ELECTRICAL REVIEW, April 23rd, 1926, p. 668), expressing the view that in both industries there would be "unalloyed satisfaction that at long last an official move has been made towards greater unity."

These overtures on the part of the gas industry are distinctly interesting—the more so, seeing that they largely coincide with the inauguration of the most intensive propaganda ever undertaken on behalf of domestic electricity supply. It is, however, a well-known fact that, whether because of or in spite of their inherently competitive nature, as electricity has advanced, so has gas—not hand in hand, but actively contending with one another.

Now, whilst it must, we think, be admitted that the co-operative production of gas and electricity, combined with the recovery of the valuable "by-products" of coal, offers the best prospects of making the utmost use of our natural resources, and doubtless will eventually come into vogue, it by no means follows that the co-operation need, or should, be carried further than the production stage. On the contrary, it appears most desirable that the spirit of friendly competition which has hitherto prevailed shall be maintained and upheld at

the distribution end of the business. Competition makes for progress and development, and is an altogether healthy and beneficial stimulus to individual effort. No better illustration of this truth need be sought than that of our railway systems. Before the war these were keenly competitive; expenses were kept down, and every effort was made to secure increased efficiency. The electrification of main lines was seriously contemplated, and in some cases seemed to be on the verge of adoption. But since the railways were grouped and competition, if not abolished, was largely eliminated, the question of electrification has been definitely dropped in all quarters so far as main lines are concerned, and the national interests, which would have benefited enormously had the conversion been effected, have correspondingly suffered.

Hence, whilst we have consistently advocated the more efficient utilisation of our fuel resources, we deprecate any movement towards amalgamation or any other change which would diminish the salutary effects of free competition between gas and electricity. Above all, we are firmly convinced that the domestic consumer's interests are on the side of the extended use of electricity in the home, and despite the most alluring blandishments on the part of the gas industry, we shall continue to support with the utmost enthusiasm the wholly admirable campaign for the "wiring of Britain's homes" which is now gathering impetus, and will soon, like the rolling snowball, attain such dimensions as shall render its triumphal progress irresistible.

Electrical Accidents: Be Prepared.

Many years have elapsed since the Electrical Review issued its "Suggestions for Dealing with Apparent Death from Electric Shock." Prepared under expert medical advice, these suggestions were of a very practical nature; they were favourably received by Government authorities, were very widely employed in all classes of electrical surroundings, and they have been a boon to hosts of engineers and others whose acquaintance with them has prepared them for emergencies. How many lives have been saved as a result of the adoption of the suggestions as a means of resuscitation it is impossible to say, but the cards and metal plates bearing them are extensively in use to-day in power stations, factories, collieries, and so forth in this and other countries. The continued demand for them is a tribute to their value and usefulness and to the desire of those who are in positions of authority to prepare their staffs for extreme eventualities. No doubt the display of the Suggestions has frequently served as a very necessary reminder of the need for the exercise of care amid what may easily become dangerous surroundings. But we have decided to work more directly in assisting our readers to prevent the occurrence of mishaps and therefore to lessen the chance of shock and the need for resuscitation methods, by issuing a small pamphlet containing a number of hints regarding the avoidance of electrical accidents. It is our intention to offer these for sale at a comparatively nominal charge, and we invite electricity supply engineers and managers (municipal and company alike), factory and workshop authorities, electric railway and tramway managers and engineers, and all classes of industrial works in which electrical equipment is installed, to advise us of their requirements. We suggest the circulation of these pamphlets among all classes of workers, whether engaged actually upon or merely in the neighbourhood of electrical machinery, wires, apparatus, &c. The notes contained in the pamphlet consist largely of extracts, reproduced with official sanction, from the valuable annual reports of His Majesty's Inspectors of Factories and Workshops. They tell in some cases what has happened, and may easily occur again unless the worker or the staff official is on the alert for his self-protection. They tell how absent-mindedness, forgetfulness, and familiarity have led to disaster, and therefore how the knowledge of possible danger and the exercise of caution amid certain surroundings may afford immunity. We shall be glad to have information promptly, as we shall print whatever number may be required. As announced in our advertisement pages, they will be sold to companies and authorities and firms in parcels of fifties, hundreds, and so on at a reduced charge according to the number called for. To individual readers who desire copies for their own use the cost will be sixpence, post free.

The National Campaign: Activity at Manchester.

With the object of officially launching the National Campaign for "Wiring the Homes of Britain," a mass meeting of the electrical trade was held in the Milton Hall, Deansgate, Manchester, on September 24th. The chair was taken by Mr. H. C. Lamb, the city electrical engineer, and the principal speaker was Mr. W. E. Bush, of E.L.M.A. The hall was packed to overflowing.

Mr. Lamb explained that in the Manchester area there were only 20,000 houses wired out of a total of 200,000, and that therefore the trade had an even better opportunity than in many other parts of the country. He laid emphasis, however, on the necessity of increasing the power load rather than merely that for lighting. Mr. Bush, in a most concise and clear manner, explained the whole scheme of the campaign, and pointed out that to get people to take up electric light was the only way, in many cases, to get them to go in for electric heating, &c. It was noticeable that Mr. Bush's clear exposition much impressed the audience, and in the discussion afterwards several small points were brought up and explained. Certain speakers showed some opposition to the fact that payment was to be made by traders for the competition books, but when it was explained how much the supply undertakings and others were paying towards the campaign, the small contribution to be made by the retailer in this way was readily agreed to. One speaker emphasised the views of many in asking that the Corporation should be a little more speculative in laying mains, and as the question was really one for Mr. Lamb, as a City representative, rather than for Mr. Bush, the former tactfully replied amidst some laughter. In conclusion, Mr. Bush dealt briefly with the embryo plans of his organisation to educate public opinion to the point of forcing the "speculative builder" to take more interest in the wiring of the house, and also gave a short synopsis of the work of the new Lighting Service Bureau to be opened at 4, Fountain Street, Manchester, on October 5th by the Lord Mayor of Manchester. The meeting was highly successful, and augured well for the success of the campaign in this area, which is under the supervision of Mr. Hawkins, of the Lighting Service Bureau in London. The district embraces a huge population, but it is hoped that many district circles and demonstration houses will be established.

A Central European Trust?

It would be interesting to learn what truth, if any, lies at the back of the reports on this question that are in circulation on the Continent. According to a report published by an Amsterdam newspaper, the formation of a central European electrical trust is impending. It would comprise the German, Swiss, Austrian and Hungarian industries. Despite the denials hitherto issued, the newspaper states that by way of a beginning, discussions are already proceeding between the A.E.G., the Siemens-Schuckert Company and the Rhine-Elbe Union for the formation of a community of interests. A further report, from Budapest, announces that in Hungarian professional circles a rumour is in circulation that the negotiations now proceeding between the above-mentioned three companies aim at the creation of a central European electrical trust, the participants in which would be the electrical undertakings in Germany, Switzerland, Austria and Hungary, although the discussions are still in an initial stage. It is added that Hungarian electrical circles regard the idea of such a trust with much sympathy.

E.H.P. Outdoor Sub-stations.

The 33,000-V Switchgear on the North Metropolitan Electric Power Supply Co.'s System.

Amongst the more recent examples of the use of extra-high-voltage outdoor sub-stations in England are those on the North Metropolitan Electric Power Supply Co.'s mains network. Five such sub-stations are to be fed from the N.M.E.P.S. Co.'s Brimsdown generating station, being connected partly by 33-kV underground cables and partly by 33-kV overhead transmission lines. Whereas it is now fairly common practice in this country to place such equipment out of doors, the Brimsdown central plant is the first instance of main generating-station switchgear being thus situated.

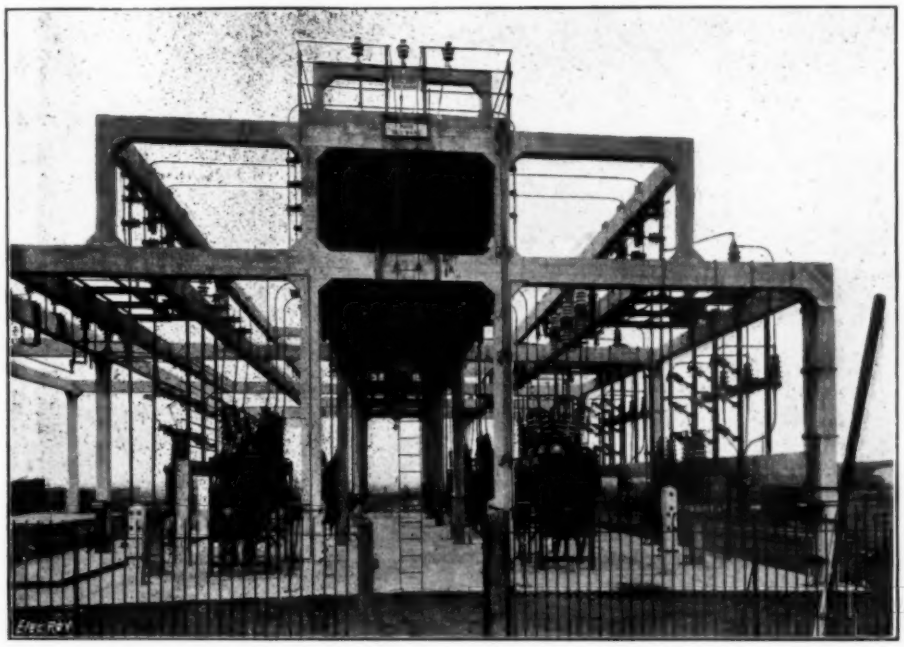


Fig. 1.—End View of Brimsdown Switchgear Structure.

Ferguson Pailin Gear.

The whole of the Brimsdown switchgear has been designed and installed by Messrs. Ferguson, Pailin, Ltd., to the specification of Capt. J. M. Donaldson, M.C., M.I.E.E., chief engineer of the North Metropolitan E.P.S. Co.

An end view of the structure is shown in fig. 1, whilst fig. 2 is a general view. The present installation comprises one 9,000-kVA transformer bank stepping up from the generating pressure to 33 kV, together with outgoing feeders and bus-coupling equipment. The installation is at present being extended by the addition of further feeders, another 9,000-kVA transformer bank, and a 31,250-kVA generator, which is to be connected solid to the step-up transformer, all switching being carried out on the 33-kV side; other similar generating sets and feeders will be added in the future. This station is interconnected with the Barking capital station of the County of London Electric Supply Co., Ltd.

As this gear is to control a central station, it will be impossible for it to be completely shut down at any time for cleaning or repairs; consequently the arrangement of the busbars has had to be such that work can be carried out in safety on one set of bars, whilst the other set and the various circuit equipments are "alive." This aim has been accomplished by arranging the two sets of busbars one above the other. A repair platform has been provided for each set of bars, whilst guard rails and ferro-concrete screens prevent independent contact with the "live" contacts of isolating switches, "live" connections, &c.

In a station of this description wherein the busbars are always "alive," it is important that painting and cleaning of the supporting structure be reduced to an absolute minimum; consequently the structure has been built of reinforced concrete, which is impervious to the atmosphere, in preference to galvanised steel.

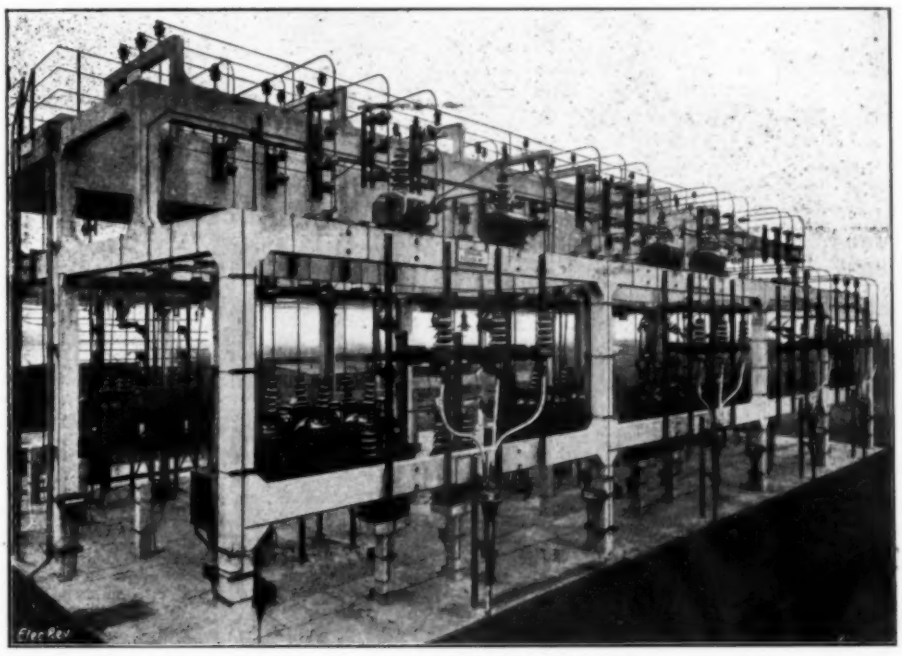


Fig. 2.—Brimsdown Power House Switching Station.

Although more expensive initially, this will prove economical in the long run.

The high-rupturing capacity oil circuit-breakers incorporated in the scheme are of Messrs. Ferguson, Pailin's type "TA," recently described in our pages, and are shown *in situ* in fig. 3; each breaker comprises three single-pole units with a common set of operating mechanism. The construction is extremely robust throughout, and the terminal bushings are of the condenser pattern, with the upper portion protected by glazed porcelain weather sheds.

All the isolating switches, with the exception of those for the potential transformers, are of the triple-pole rotary pattern, hand-wheel operated from the ground level. On the feeder isolators separate earthing blades, complete with hand-wheel operating mechanism, are so arranged that the phases are earthed successively and not simultaneously. Auxiliary contacts on the mechanism operate the semaphone diagrams on the control board. Each circuit is also provided with a by-pass isolating switch, connecting the circuit direct to the auxiliary busbars, to enable the oil breaker in any circuit to be made "dead" for inspection, cleaning, or repairs, whilst the supply to the circuit is maintained through the by-pass switch, auxiliary busbars, and automatic bus-coupling oil circuit breaker.

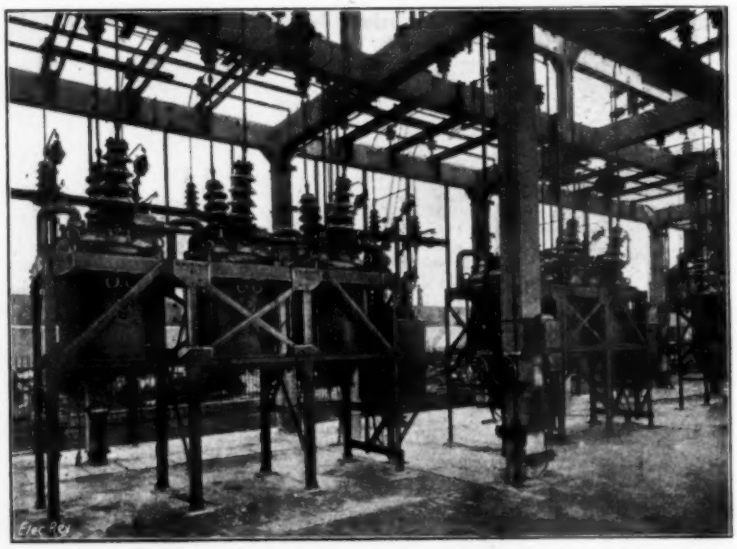


Fig. 3.—Oil-immersed Circuit Breakers at Brimsdown.

Balanced protection has been employed throughout, except on the bus-coupler switch, outdoor pattern current transformers being used; transformers of the outdoor compound-filled wound-primary type are also used for metering purposes. All the other current transformers are of the bushing type mounted on the circuit-breaker terminal bushings underneath the top plate.

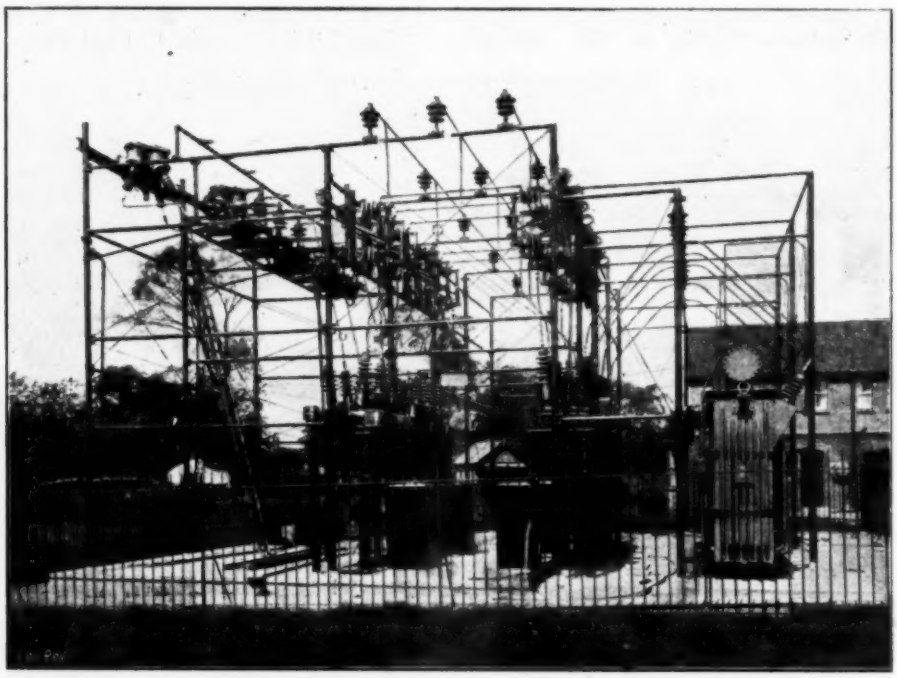


Fig. 4.—Stevenage 33,000-volt Sub-station under Construction.

Special attention has been paid to the lighting equipment on the outdoor gear to enable switching operations, &c., to be carried out at night. G.E.C. "Wembley" lanterns mounted on suitable standards are situated all round the structure and, in addition, lighting points have been provided in the main gangway below the two sets of busbars. Power plugs are also fitted at suitable points on the main uprights.

The circuit breakers are remote electrically-operated by d.c. solenoids, the control panels being situated indoors in the power station. An indicating diagram runs the whole length of the board at the top, and semaphores operated by auxiliary contacts on the various circuit breakers and isolating switches, &c., show the operator the state of the system. The synchronising gear is mounted on a separate pedestal.

B.T.-H. Equipment.

The first five sub-stations situated at High Barnet, Potter's Bar, Welwyn, Stevenage, and Knebworth will form the first part of a ring-main system, an incoming and an outgoing feeder being provided for at each sub-station, with one or more step-down transformer banks. In certain instances, however, arrangements can be made for feeding into the 33,000-volt line from the low-pressure side of the power transformers.

The switchgear for these sub-stations has been manufactured by the British Thomson Houston Co., Ltd and that for three additional outdoor sub-stations at Hitchin, Edmonton, and Tottenham is now in course of manufacture by this Company. The Hitchin sub-station is to be on the same ring main as the five previously mentioned, those at Edmonton and Tottenham being on a separate radial feeder from the generating station. The gear for the first five sub-stations includes a 150-ampere incoming feeder equipment in each instance and an outgoing feeder equipment of equal capacity, except at Potter's Bar, where there are two such sets of equipments; at this sub-station are also two 500-kVA transformer feeder equipments with provision for two additional equipments. Similar arrangements have been

made at Stevenage and Knebworth, while at High Barnet and Welwyn there is a transformer feeder equipment rated at 3,000 kVA.

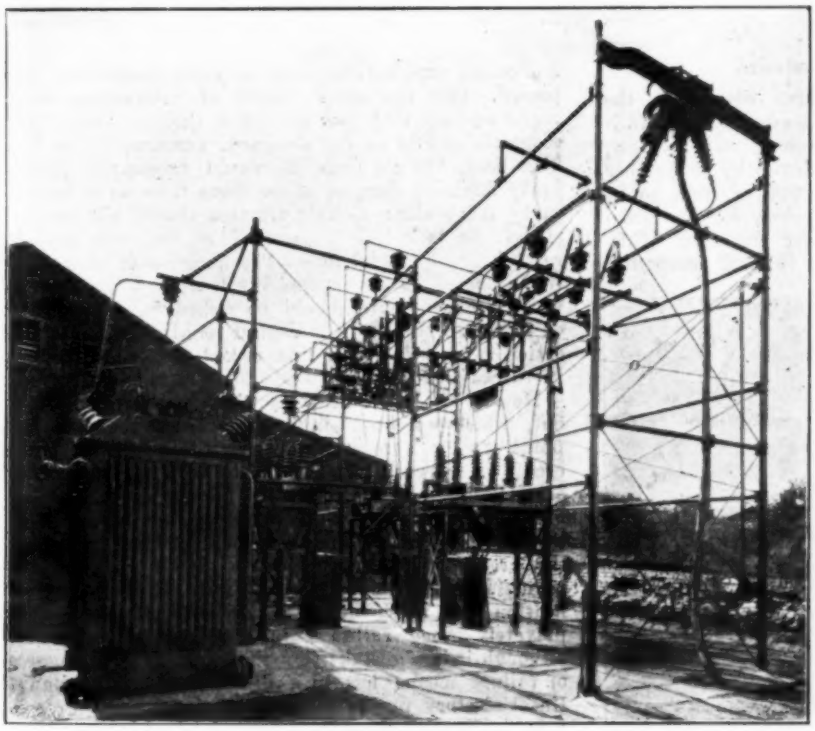
At High Barnet and Stevenage the oil circuit breakers are electrically operated, and at the other three sub-stations they are direct hand operated. The control panels are mounted indoors.

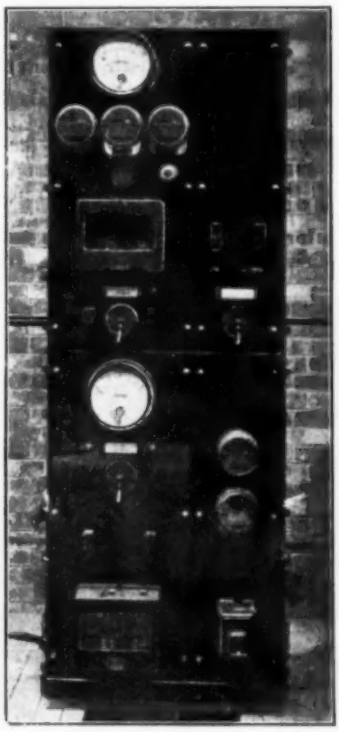
At first the Potter's Bar and Welwyn sub-stations will not be connected to the 33,000-volt transmission line; the 3,000-kVA bank at Welwyn will be used as a step-up transformer to supply Welwyn, Knebworth, and Stevenage, and during this stage the Brimsdown generating station will supply the High Barnet and Potter's Bar sub-stations only, but at a later stage of development Brimsdown will feed the five sub-stations, and the 3,000-kVA bank at Welwyn will be used as a step-down transformer. During the initial stage the neutral on the 33,000-volt side of this transformer will be earthed through a resistance and an oil switch; later, when the five sub-stations are connected together by the 33,000-volt transmission line, the system will be earthed only at Brimsdown.

to allow of the breaker being closed. The hand-operated breakers are also weatherproof, and to comply with the requirements of the Home Office the height of their frames is such that the distance from the ground level to the lower end of the external insulators of the breaker bushings is 8 ft.

The incoming and outgoing feeder equipments are provided with both busbar- and line-isolating switches, whilst the transformer equipments are provided with busbar-isolating switches only. The line-isolating switches are provided with earthing contacts; in both cases these switches are of the 3-pole single-throw pattern arranged for remote mechanical operation at the ground level. The switches can be padlocked, and the line-isolating switches are arranged so that it is impossible for an operator to pass inadvertently from the closed to the earthed position without pausing in the open position.

The insulators are standard 44,000-volt, single-pin units, provided with a flanged steel fixing foot and drilled iron cap, each unit consisting of several brown glazed vitrified porcelain shells cemented together.





Figs. 5 and 6.—High Barnet Sub-station, Approaching Completion, and Control Panel.

All the switching apparatus has been specially finished to withstand severe atmospheric conditions: Operating-mechanism parts have been zinc plated and all steel framework was hot galvanised after all machining had been completed; isolating-switch blades and clip contacts have been electro-tinned; all castings which were too large to be zinc plated were scaled free from rust and painted with two coats of a bitumastic protective solution, the pipe framework structure being similarly painted after assembly.

The switchgear is mounted on self-supporting pipe structures, as shown in the accompanying illustrations, figs. 4 and 5, embedded in concrete foundations.

The 33,000-volt oil circuit breakers are of the B.T.-H. OM.201-WA1 type, rated at 300 amperes; they consist of three single-pole units arranged for solenoid and direct hand operation. The solenoid operating mechanism is weatherproof, and is designed so that the closing of the breaker is positive and independent of the operator, there being a time lag on the re-setting of the closing relay, the contacts of which carry the main solenoid-closing current. Due to the construction of the magnetic circuit a hesitating feature is introduced to ensure that sufficient time will elapse between the closing of the contacts and their opening, or re-setting.

Busbars and connections consist of $1\frac{1}{4}$-in. outside diameter hard-drawn copper tube with screw-up cone connectors for making joints.

Incoming and outgoing feeders are provided with opposed-e.m.f. protective gear, the relays being energised through biasing transformers from the bushing-type protective transformers mounted in the oil circuit breaker bushings. Certain feeders have been provided with additional induction-pattern definite minimum reverse time-limit overload relays. The protective relays are of the double-pole pattern, with line- and earth-fault elements contained within one case; they are of the vibrating-reed type, which is immune from operation due to the occurrence of frequencies other than the supply frequency of the particular system.

The 500-kVA transformers at Stevenage, Potter's Bar, and Knebworth have overload protection on the 33,000-volt side, and the direct hand-operated breakers at Knebworth and Potter's Bar have direct-acting overload trip coils energised from bushing-type current transformers and short-circuited by means of time-limit fuses. At Stevenage, where the breakers are electrically operated, the bushing-type current transformers operate a type "SH" overload relay, which trips the transformer breakers through the agency of their d.c. shunt

trip coils. The 3,000-kVA transformer bank at Welwyn is provided with 4-wire leakage and overload protection: three brushing-type current transformers, mounted in the oil circuit breaker, are connected in parallel along with a fourth in the neutral on the 33,000-volt side. A single-pole leakage relay is connected across the common terminals of the bushing transformers so that it operates only on the occurrence of a fault on the 33,000-volt windings of the transformer bank; an overload relay is in circuit with each of the three bushing transformers mounted in the oil circuit breaker.

When the bank is used for step-down purposes only, the 4-wire leakage gear will be removed, and protection will be arranged similar to that at the High Barnet sub-station, which is provided with overload and leakage protection, but (as this transformer is being used for step-down purposes only) the fourth bushing transformer in the neutral connection is not provided; the leakage relay is connected across common terminals of three bushing transformers only. Two phases are each provided with an overload relay.

The multi-core control cables are of three sizes only, paper-insulated and lead-covered, with steel-tape armouring in the case of those for the main closing solenoid circuits of oil circuit breakers.

The World Power Conference.—IV.

Impressions and Reflections.

By THEODORE RICH.

The Electrification of Railways.

The general report of Dr. E. Huber Stockar, of the Electrification Department of the Swiss Federal Railways, differs in a way from the other general reports, because, at the time when it was drawn up, a number of the papers for discussion had not arrived, so in the preparation of it the author drew largely from information obtained through other channels. This report, which can be recommended to those interested

(Photograph by courtesy of the Swiss Federal Railways).
Fig. 1.—Power Station at Amsteg on the Gothard Railway.

in railway problems, was translated into English, and copies are obtainable from the Swiss Committee of World Power Conference.

In his opening remarks, after referring to the interesting data contained in the papers presented from various countries, the author pointed out that for a long time the technical and economic advantages of electric traction remained doubtful. It has now, according to some of the views expressed, achieved superiority, and through it some results have been obtained which are impossible with steam locomotives. Electric traction not only benefits the public, but also the railway *personnel*; from the point of view of economics, expectations have in many cases been surpassed. One has never heard of authorities which regretted that they had electrified their railway. The economic results so far obtained, encouraging as they have been, are not such as would necessarily justify heavy financial charges, where steam traction is able to carry the traffic; electric traction should not be considered as technical progress if at the same time it results in a financial loss. The question of electrification is based on the expense involved, and the point is whether expenditure should be risked in anticipation of increased traffic. The capital required for electrification is much less than that risked in other directions in railway matters.

Most of the electrifications which have been carried out, which were not imperative from the technical point of view, were undertaken by State railways whose credit is more or less the function of the interior or exterior credit of the country. In such cases questions of public economy arise; for instance, the utilisation of hydraulic power, the encouragement of home industry, the creation of opportunity to give work, and the reduction of the importation of coal. Railway electrification is of much interest to a State that it may help privately-owned railways in the matter of finance, although it is a mistake to assume that financial success or failure means less to a State than to a company. Unsatisfactory results endanger national credit; it is a fact, however, that State financial backing has been a great influence towards electrification. In a number

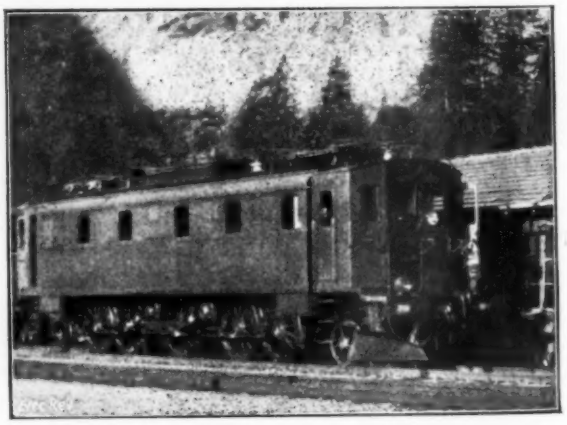


Fig. 2.—Single-phase Locomotive of 2,500 h.p. at Kandersteg on th Loetschberg Railway.

of countries, important companies or the State have adopted a definite current system within their boundaries, and have thus removed a definite obstacle to electrification. Only one country which has successfully electrified a number of lines shows uncertainty

with regard to the system to be used for new electrification—that is the United States.

Where uncertainty exists, those thinking of electrification are perplexed, but now that the system competition is over, the quality of the execution is more important than the system. The question whether there should be separate generation for railway operation, or purchase of supply from outside concerns, depends more on circumstances than on principle. There are two problems—the electrification of new lines, and the electrification of existing steam-operated lines. There have been but few new lines electrified from the start. The Swiss lines from Burgdorf to Thun, 1899, and from Frutigen to Brigue, 1913, over the Loetschberg, are among these. Where new lines are concerned, quantities of apparatus required for steam operation are not rendered useless by the change.

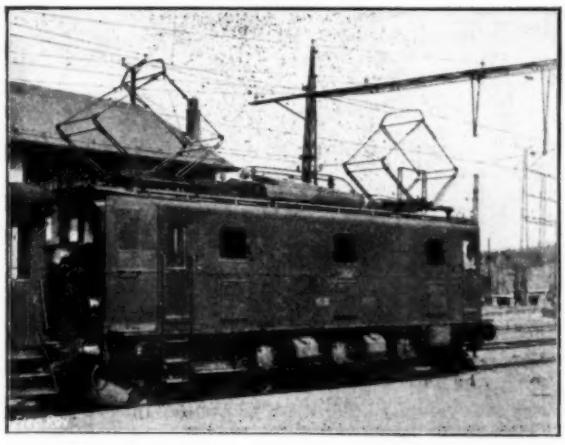


Fig. 3.—Secheron Single-Phase Locomotive with 6 motors, on the Swiss Federal Railway.

Among those electrifications most interesting at the moment are those (*a*) dictated by purely technical questions, (*b*) where economic and technical conditions make the matter imperative, and (*c*) those where electrification is not urgently required, but where special circumstances make it advantageous, as in the case of small-scale test sections or special lines or groups of lines where steam traction has become unequal to the requirements.

The electrification of purely tunnel lines forms an important group under (*a*)—the Cascade, the Detroit, the Hoosac, and the Simplon tunnels are examples of successful operations. In long tunnels electrification becomes compulsory owing to smoke difficulties. The equipment in such cases is not costly, and requires but small capital in proportion to the total tunnel costs. The economic and technical results of their operation have enabled useful comparisons to be made and valuable maintenance experience gained. With group (*b*) can be included the electrification of important terminals with their access lines; the Quai d'Orsay, the Pennsylvania, and the Grand Central station at New York are examples of this. Under the same heading can be included the working of underground and congested suburban lines, and mountain lines with heavy gradients, of which last the Gothard is an example. In each case the idea has been the anticipation of increased traffic.

The question of smoke has been an important factor, but the decisive argument comes from the conviction that where urban and suburban traffic is intense, it is only by electrification that outside competition can be met. In a number of cases of such electrification, long or numerous tunnels and steep grades have been factors. It might be said by some that traffic could be handled under such circumstances with more powerful steam locomotives, but there is no doubt that railways with large traffic like those of the Alps, with numerous long grades and tunnels, have found in electrification the best means for facing competition and increasing their traffic capacity.

To certain electrified lines in Sweden and in America, where heavy trains are handled over steep grades, the availability of energy from water-power stations and the extra hauling capacity of electric locomotives have been of great advantage.

Railway specialists have known for a long time that electric traction has a superiority over steam, where—

1. The traffic is very intense.
2. The coal is dearer.
3. Electrical energy is cheap.
4. Labour is dear.
5. The grades are heavy and numerous.
6. The capital charges required for electrification are low.

The difficulty is to know whether such factors are sufficiently strong to justify the responsibility of electrification. The best and most appropriate way to facilitate progress in this direction is to disseminate continuously the information acquired from practical experience with existing installations under the ruling traffic conditions.

Railway electrification is rich in literature, but there are difficulties owing to the different ways in which the factors are brought out, especially when comparisons are made with steam traction. In order to facilitate matters, the general reporter, Dr. E. Huber Stockar, has drawn up a *questionnaire* on railway operation and technical points, which is attached to the report. This *questionnaire* deals with such subjects as length of lines and track, number of stations, gross variations of level, traffic, consumption of coal, water, and energy, general and establishment charges, number of locomotives and automotive cars, &c., power of locomotives, operative *personnel* and their cost; in all 83 points are dealt with in the schedule.

In the discussion on "Railway Electrification," the general principle of the *questionnaire* and schedule was approved of, and opinions were expressed that the

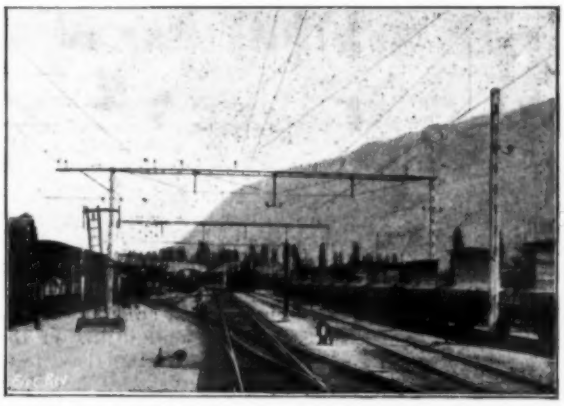


Fig. 4.—New Type of Overhead Construction used at Stations on the Swiss Federal Railways (Rhone Valley) with Ferro-concrete Supports.

existence of means by which such information could be obtained by those interested would form a valuable aid towards railway electrification.

Inland Navigation and Power Generation.

In the Exhibition many Continental countries gave evidence of their interest in inland navigation; France, Germany, Austria, Sweden, Holland, Belgium, and Italy had remarkable exhibits. One may well ask: "How can this interest the electrical engineer?" From Basle to the sea there is port after port, of which diagrams and photographs were to be seen, equipped with high-powered cranes, coal transporters, capstans, conveyors, pneumatic unloading plant, and so on, and in nearly every instance electric motive power from local mains is used for their operation. At the Port of Ruhrort the traffic tonnage handled is comparable with that at many ocean ports. In some parts of the Continent canals are being equipped with electrically-operated lock gates and sluices to enable the traffic to be dealt with expeditiously.

In France, in the northern coal area, electrical canal haulage by means of trolley-fed locomotive tractors on

rails, a system which was started before the war, is going ahead, and now several hundred tractors are at work; naturally, however, such a system only becomes practicable when the tonnage hauled per tow is considerable.

From questions of inland navigation proper, one passes naturally to that of the utilisation of the flow in navigable rivers and canals for the purpose of power generation. In a canal or a canalised river it is not unusual during the dry season for the bulk of the water flow to be taken by the locks, and in any case the only water available for power production is that which would otherwise flow over the weirs. Some of the points emphasised in papers on inland navigation, and the admirable summary of Dr. A. Strickler, an engineer, of Berne, presented at the World Power Conference, indicate that the problem is not nearly as simple as would appear at first sight.

In the first place, we have in most cases a variable flow and variable traffic, which means a variable loss through the locks, and, in the case of the normal power station, a variable demand for power. If there is not ample water and there is a load peak, a seemingly natural method would be to bank up the water to take it; this would mean that the banks must be high enough to take the rise, and the water level on the down-stream side may be unduly lowered on both sides to the inconvenience of navigation. Mr. Hoebel, of Germany, in his paper, No. 24, considered that such power stations should supply into existing networks to avoid peak difficulties, and said that to avoid danger to shipping in the new combined power and navigation canals the water velocity was limited to 0.70 metre per second. Mr. Dautscher, also of Germany, and Dr. Strickler, of Switzerland, consider that dams should not be used to accumulate water by means of raising the level. If a quantity of water has been stored in a long reach, and it has to be let out rapidly to take the peak, the velocity may become inconveniently high for navigation.

It was pointed out that, where there was a possibility of utilising a river for navigation at a later date, space should be left so that a lock could be built without unnecessary expense; this was done in the case of the Lower Isère power installation, which was described in the Electrical Review of May 28th and June 4th, 1926.

Mr. Dupin, of France, outlined a proposal to utilise the waters of the lower Seine in four stations estimated to give a combined minimum of 9,400 h.p. and a maximum of 60,000 h.p. Judging by the papers and certain remarks in the discussion, it seems to be the general opinion that power generation combined with navigation begins to be, under favourable circumstances, a practical problem, even with small falls, where the dams, weirs, and other strictly river works have their capital charges allotted to the navigation, while only the power-station costs are earmarked to the electricity supply.

Except in Switzerland, where, apart from the short stretch of the Rhine at Basle, navigation is not of great importance, there seemed to be the opinion that power production, considering the requirements regarding levels, water velocity, &c., should be looked upon as a secondary matter as compared with navigation; in Switzerland the reverse was the case.

If one can judge by the papers and discussion, there are a number of combined installations in effective economic operation, although it is the kind of project which requires the most careful design and study by men of high standing, especially because an undertaking like this has attractions for the man in the street and to the professional politician, so that without the greatest foresight economic failure may easily result.

Fault Localisation on Cables.

New Applications of the Kenotron Apparatus.

By N. A. ALLEN, M.Sc. (Eng.)

This is the last of a series of four articles which have appeared in the Electrical Review* on the subject of the tests which are applied to high-pressure cables after installation, so as to ensure that no damage has taken place during the process, adopting direct current at a high pressure as the testing medium in accordance with modern practice. The convenience and utility of the two-valve Kenotron apparatus for applying these tests has been demonstrated, and in addition it has been shown how a study of the behaviour of the dielectric may be made during the testing period. The present article attempts to describe yet another feature of this type of testing outfit which gives it a further advantage over other types of apparatus.

Faults on Super-Pressure Cables.

The cable-maker's art has reached such a high degree of perfection that actual breakdowns are uncommon; breakdowns such as do occur can often be traced directly to some mechanical damage either internal or from without, and it frequently happens that faults of this kind take many months to reveal themselves. Other faults may be attributed to a progressive weakening of the insulation caused by a succession of high-voltage surges on the transmission system.

Phelps and Tanzer† have shown how the Kenotron may be used for predicting breakdowns, by making periodical tests and by observing the leakage current to the cable on a d.c. test.

Nature of Faults.

Owing to the heavy thickness of dielectric on super-pressure cables, it happens almost invariably that when faults develop, they are difficult to localise on account of their extremely high resistance. Thus it is possible for the installation engineer to be faced with the proposition of localising a 20-megohm "fault" in a long stretch of ten miles or more of cable having an overall insulation resistance when sound throughout of 50 megohms, these figures being taken with the 1,000 Megger. When the working or testing pressure is being applied, however, the fault is more definitely present and may, for the case cited, reach 100,000 ohms or lower, thus demanding immediate localisation and repair. When the cable is rendered "dead" again for the Megger test, the fault resistance is found to have risen to 20 megohms once more.

It is impossible to make use of the well-known methods of fault localisation for these high-resistance troubles, as the results are not accurate enough to warrant opening the ground and cutting the cable at the spot indicated.

As an example of the nature of the high-resistance faults which are encountered, consider the case of a joint inside which, through the ingress of moisture, incomplete compound filling, or other cause, an internal flash-over has occurred during the integrity tests after installation. At the moment when breakdown takes place, the cable discharges its internal energy through the arc, thus reducing the testing voltage to a low value for many seconds while re-charging goes on. During this period an oil-flow may occur, carrying away the charred particles which constitute the path of the arc. The fault has thus vanished for a time, or even alto-

*Electrical Review, August 6th and 20th, and September 10th, 1926.

†*Journal* of the American Institute of Electrical Engineers, March, 1923.

gether. When the breakdown has finally been established, in the form of a long irregular chain of carbonised particles, its ohmic resistance is naturally high.

There are then two courses open.

Either (*a*) the fault must be broken down to a low-resistance value so that localisation tests by one of the usual methods may be made; or (*b*) means must be devised to localise at the existing high-resistance figure.

Use of Kenotron for Reducing Fault Resistance.

In order to test the Kenotron set to discover whether it was capable of being used to burn out a fault, a sample of 12 ft. of 0.15 sq. in. three-core cable was experimented with in the laboratory. The insulation thickness was 0.20 inch of paper between the cores and the lead sheath, and 0.20 inch between cores; the cable withstood 130,000 volts d.c. for ten minutes without breaking down.

A pin was then driven into the lead and withdrawn; the pressure was again applied, whereupon arcing took place, reducing the resistance from infinity to a few ohms in a quarter of an hour.

As the above experiment was not regarded as completely conclusive, since burning would naturally follow the arcing through the air space formed by the pinhole, another test was made. A cut was made through the belt insulation and moisture was introduced. The 500-volt Megger registered infinite resistance at this stage. Pressure was re-applied and a breakdown took place at 130,000 volts d.c. The Megger again indicated

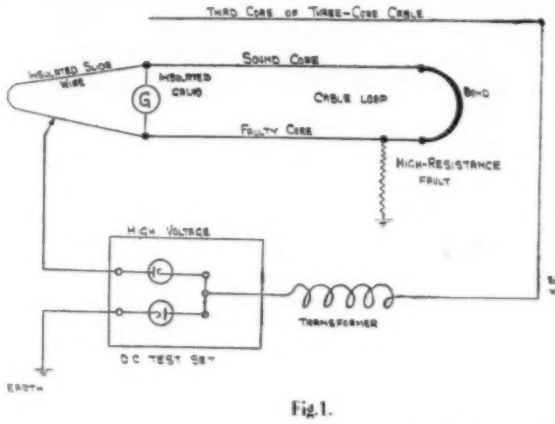


Fig.1.

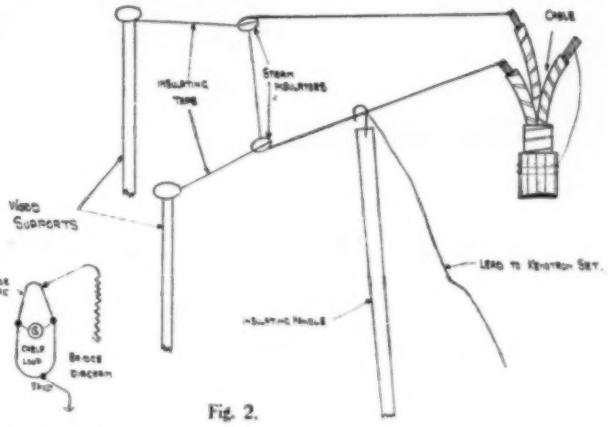


Fig. 2.

Method of Localising Faults at High Pressure.

infinity, and it was considered that the conditions were identical with those which are encountered in the field, *viz.*, high resistance with 500 volts d.c., but low resistance on the high-voltage test.

The cable was then closely wrapped with mica and black sticky tape to prevent the presence of air allowing a conflagration to burn the faulty place. High-voltage d.c. was then applied so that 0.080 ampere passed continuously for twenty minutes. At this stage the 500-volt Megger registered zero insulation resistance. To verify this, a neon lamp in series with the fault was lighted successfully on a 220-volt circuit, and finally when the high voltage had again been used for five minutes, it became possible to pass 0.0017 ampere with a 4-volt battery, equivalent to 2,400 ohms fault resistance.

The conclusion was consequently obtained that the Kenotron set is capable of burning out a high-resistance fault in a reasonably short period. Since this conclusion was reached by testing a short sample of cable, and moreover since the sample had only an insulation thickness equivalent to 6,600 volts working pressure, it was desirable to have a confirmation that faults on long lengths of super-pressure cable may be burnt out with equal facility. A subsequent test was therefore carried out in connection with a recent contract for supervolt cables, when it was ascertained that a fault resistance equivalent to 50 megohms can be broken down to about 20,000 ohms within two to four hours, so that the ordinary localisation tests may be used with a reasonable degree of accuracy.

New Method of Fault Localisation at High Pressure.

When localisation tests are being made, it is often highly important that the results should be obtained rapidly, and hence the four hours expended in burning out the fault must be eliminated.

Attempts have been made from time to time to carry out a loop test at high voltage by using a Delon apparatus instead of the usual low-voltage battery. These failed because of the surges set up by the Delon set. The Kenotron apparatus is not liable to voltage variations and surges, and therefore proved suitable for localisation testing.

The new method, which is in effect a high-voltage Varley loop test, was experimented with and successfully used in connection with the joint faults previously described. The connections, illustrated in fig. 1, are very simple, and, provided the necessary precautions are observed, the danger to the operator is not unduly great.

High-voltage d.c. is applied to the cable through the contact hook on the slide wire, in the manner shown in fig. 2, the galvanometer being connected across the free ends of the cable cores. The galvanometer is insulated on a porcelain stand, while the slide wire is slung up in a convenient manner between strain-type porcelain insulators. The contact to the slider is made through a hook on the end of a long insulated handle, which enables the contact point to be moved freely until a balance is indicated on the galvanometer. The calculations are then made in the usual manner to find the distance of the fault along the cable.

A single example will suffice to demonstrate the accuracy of the method. A fault appeared in a length of 6,000 yards of 3-core 22,000-volt cable, the fault resistance being 5 megohms on a Megger test and 50,000 ohms on high-voltage test. The pressure at which the loop test was conducted was 5,000 volts d.c., and localisations from opposite ends of the cable gave the following results:—

Total length of cable	...	6,000 yards.
Localise from one end	...	1,566 yards from datum.
Localise from other end	...	1,579 yards from datum.
True position of fault	...	1,566 yards from datum.

Maximum deviation from correct position, expressed as percentage of total cable length

$$=100\times(1,579-1,566)/6,000=0.2 \text{ per cent.}$$

The accuracy of the new method is thus established.

Conclusions.

(1) The Kenotron apparatus can be utilised for burning out high-resistance faults on cables within a few hours, sufficiently to permit of making accurate localisation tests by the usual methods.

(2) The Kenotron can be used for a new high-voltage loop test localisation method for high-resistance faults.

The author is indebted to Messrs. Standard Telephones and Cables, Ltd., for permission to describe the Kenotron set, of which details have been given in this series of articles.

The German Wireless Exhibition.

A New Thermionic Valve and Some Loud-Speaker Developments.

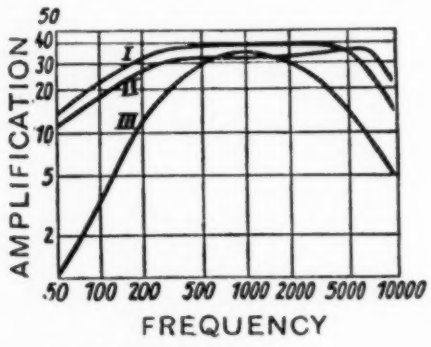
(By a Correspondent.)

The Grosse Deutsche Funk Austellung is held in Berlin each year, and this year's show (September 3rd to 12th) being the third of the series, may not unreasonably be regarded as a test of the state of the German wireless industry. If well supported and well attended, it is possible to argue that the crisis through which the wireless and every other productive industry has been going may have passed its worst point. The Exhibition was first held in 1924, when there were 246 exhibitors; in 1925 there were 212, and this year there were 250. It is held in the Haus der Funkindustrie, which was erected about three years ago of a special construction without any large masses of iron or steelwork in roof or walls, so as to render it especially suitable for wireless exhibitions by permitting receivers to be demonstrated as well as shown therein. Although it is admitted in informed wireless circles that the building is by no means technically perfect, it is undoubtedly an advance on any other large building available for such exhibitions. By the side of the exhibition hall is a large steel tower, fig. 1, some 135 metres high, and it is interesting to note in connection with the gradual improvement of the capital position in Germany that this tower, which had been standing for nearly three years in an unfinished state, has just been completed by the addition of an electric lift to the summit, and the erection of a well-equipped restaurant some 50 metres up, both tower and restaurant being opened on the first day of the Wireless Exhibition this year.

British or foreign participation was not officially permitted under the regulations, but in spite of this fact there was observable for the first week a big exhibit of Ferranti AF3 intervalve transformers (fig. 2) on the gallery, in charge of the Company's own engineer, Mr. E. H. Miller. This transformer is being placed on the German market at a price of 27s., retail, and though it would be absurd to underrate the difficulties which confront an English maker entering the German market at this date with a high-priced wireless article, especially in the face of such competition as exists there in l.f. transformers, the task of selling British goods in Germany is by no means an impossible one, as the present writer can vouch from recent experience. It is probable, however, that the best time for British makers of high-class wireless components to have secured a foothold in that country would have been towards the end of 1923.

Fig. 1.—Steel Tower in Exhibition Grounds. Fig. 2.—Exhibit of Ferranti L.F. Transformers.

Fig. 3.—A German L.F. Transformer.



Curve I—Telefunken transformer 1 : 4
Curve II Telefunken transformer 1 : 3·15
Curve III—Other make of transformer.

Fig. 4.—New Telefunken L.F. Transformer Amplification Curves.

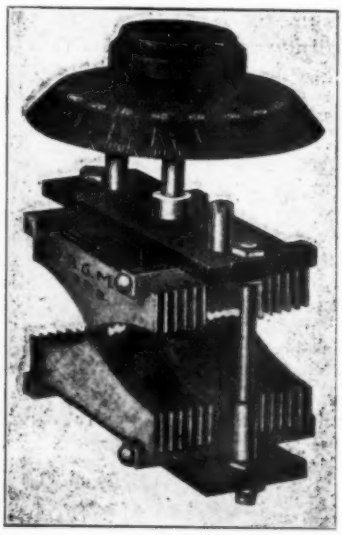


Fig. 5.—"Rakos" Lateral-movement Variable Condenser.

The prices of l.f. transformers in Germany have been strikingly low for some time, and it may be mentioned that there is a cheap make known as the "Weilo" which retails at 7s., and a number of other makes round about the same figure. In their praiseworthy attempt upon foreign markets, however, Messrs. Ferranti have some excellent data to show in the way of ampli-

fication curves which, in Germany, are probably only rivalled by the new Telefunken transformer (figs. 3 and 4).

In the cheap telephone trade, which was referred to in our report upon last year's exhibition, when receivers were obtainable in shipping quantities at prices in the neighbourhood of 5s. a pair for instruments of decent quality, there seems to be no further development, the prices ruling being about the same as last year. In the interval, with British prices reduced, the discrepancy between cheap German and cheap British headsets is no longer so striking as it used to be. The reasons for the strong position gained by German makers in this line have never yet been thoroughly examined, but it seems possible that some portion of their success may lie in the minute system of specialisation which is adopted; for instance, a glance through any radio trade journal in Germany will show dozens of advertisements of magnet coils, of diaphragms, of earpieces, and other different component parts of telephones, showing that the trade there is sectionalised to an extent which is undreamed of in this country.

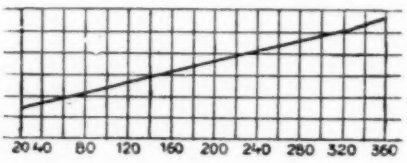


Fig. 6.—Frequency Line of "Rakos" Condenser.

The opinion was expressed by several makers that the telephone markets of the world are now fairly well supplied, and that increasing attention must now be devoted to loud-speakers. This, of course, is the policy which has been apparent on the part of British makers for nearly two years, and that the same view is now beginning to be held widely in Germany is evidenced by the large number of new makes of loud-speaker which was observable on all sides, although so far as reproduction is concerned many of the cheaper types left much to be desired. One firm of makers, well-known in this country both on account of the trade it has done in telephones as well as the publicity it has received for its deep-sea diving outfit in connection with a recent submarine disaster, has been prominently advertising the fact that it has shipped 70,000 loud-speakers to the United States during the space of two months, which

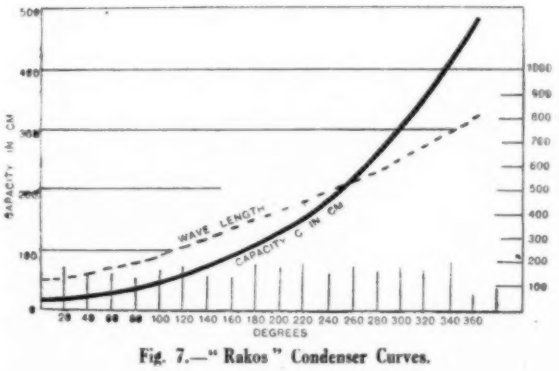


Fig. 7.—"Rakos" Condenser Curves.

is some indication that competition in this line is bound to be formidable in the future.

Regarding wireless components, the apparatus which seems to have had the most attention of late is the variable condenser, of which there was shown a variety of new patterns, many of them of most interesting construction mechanically, although it is doubtful whether from a technical point of view the variations from standard serve any very useful purpose. Fig. 5 shows a new lateral movement condenser brought out by Ottmar Freitag, termed the "Rakos," permitting the use of a full 360-degree dial, thus spacing the stations more widely than does an ordinary 180-degree disk and movement; figs. 5 and 6 show the frequency line and other curves of the instrument.

There was a number of makes of porcelain valve holders on view. Insulating tubing, both for wireless and electrical machinery generally, was shown by three or four exhibitors, one new type for wireless instruments being plaited round with fine-gauge copper wire which is intended to be earthed. In the case of coil holders the tendency was all towards cheapness in construction. Crystals still remain at 1s. 6d. each, but the typical German plug-in detector units seem to be down to a more reasonable level in price than they were twelve months ago. There was nothing particularly new in l.f. transformers, as the multiple-ratio type shown has now been on the German market for considerably over twelve months.

A new valve is attracting much attention in wireless circles. It is the "Dreifachröhre," or "three-in-one valve," made by the Loewe Co., the method of connection of which is shown in fig. 8. This valve is claimed to take the place of three of the ordinary type, and is priced at 17s. 6d., plus 7s. licence. When it is employed the receiver need only embody a variable condenser and coils, and as an example of how it cheapens the cost of receivers, sundry instruments were shown both of the old and the new types: the new No. OE333 local-station receiver complete with the Loewe "Dreifachröhre" was

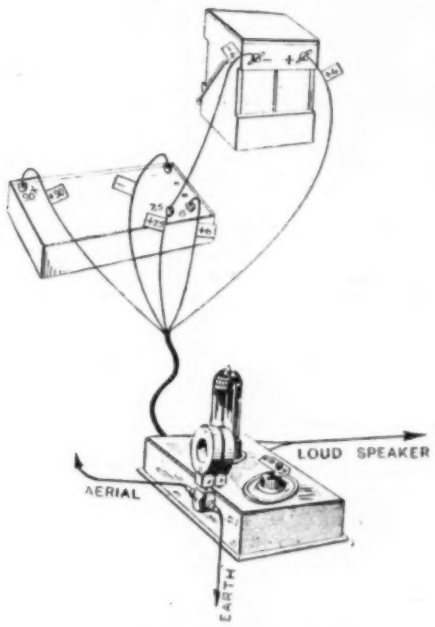


Fig. 8.—Method of Connecting New Loewe Valve.

quoted at 31s. 9d., plus licence 7s. 9d., making a total of 39s. 6d. for an instrument claimed to give results equal to the ordinary three-valve set.

Concerning receiving sets, apart from this drastic departure, the ordinary local-station instruments appear to have undergone no particular alteration during the past year. As a typical example of prices ruling in Germany for sets, the four-valve reaction instrument, made by Messrs. Ferdinand Suchardt, may be mentioned, embodying h.f., detector, and two stages of l.f. amplification, and selling retail at £7 10s. The same company also showed a detector and l.f. unit, priced at £2 10s., which can be coupled to a two-valve amplifier, priced at £2 5s., making up a complete instrument which, though it might not appeal to the serious experimenter at all, evidently has a market on the score of price. Neutrodyne and super-heterodyne instruments receive almost as much attention as in this country and the American States, and a set of parts for a six-valve neutrodyne, complete with cabinet, is put up by the Apparatebau G. Schaub, G.m.b.H., at a price of £12.

Amongst the more interesting exhibits by the large firms, the Telefunken Co. devoted a considerable amount of space to the recent developments in picture transmission by the Karolus system, with examples of both transmitting and receiving apparatus, as well as specimens of photographs, script, music, and other matter transmitted by the process, with an indication of its extraordinary speed. Another of the old-established wireless firms, the Deutsche Telephonwerke u. Kabelindustrie A.-G., of Berlin, had on view specimens of the different types of wireless instruments it has manufactured since 1913. On the gallery, the German postal authorities had also brought together a larger exhibit of the same nature, comprising some 300 receivers showing the development of broadcasting sets since 1923.

In the case of a gathering of such extent, with its many thousands of exhibits, it is necessary to sum up in general phrases: The exhibition showed that whatever may be the difficulties under which the German wireless industry has been working, both in respect of shortage of capital and restricted buying power of the home market, it is hoping by concentrating its resources upon the annual Berlin exhibition to secure the lion's share of the wireless trade of the Continent, for which, indeed, it is well situated geographically. Whether the business done at an exhibition of this kind is good or bad, there is, of course, no satisfactory means of determining, and one can only comment upon the fact that it was the largest which has been held, and that the organised manufacturers supported it exclusively. It was, therefore, an exceptional opportunity of studying at close range the directions in which German design and ingenuity are tending, and even though there may be no very marked technical advance, each of the three shows held up to the present have been well worthy of a visit on the part of any British manufacturer wishing to keep himself posted as to the competition he is likely to encounter in the different wireless markets of the world.

A New Type of Electricity Meter.

The Rent Meter with No-Load Running.

By R. AMBERTON, M.I.E.E.

If electricity could be stored, a great deal of the thought and ingenuity which have been devoted to methods of fixing the price of electrical energy would have been unnecessary. Storage on a suitable scale being out of the question, electricity has to be generated to meet momentary requirements. This involves the provision of sufficient generating plant, switchgear and mains to meet the maximum requirements, and it follows that a large proportion of this expensive equipment is necessarily idle for a considerable part of each 24 hours.

From the point of view of the supply authority it is obviously desirable for the minimum load to approach as nearly as possible to the maximum capacity of the generating station; in other words, to have a good load factor. This desideratum is equally important to the consumers, taken as a whole, as a good load factor reduces the costs and thus results in a cheaper supply of power. It is therefore to the interest of all concerned that those consumers who take a steady load for a large part of the day should be encouraged. On the other hand, a supply of electricity should be available for all who want it, and, as far as possible, the charges should be on the same basis.

The nearest approach to a system of charging simple to understand and which enables all consumers to be dealt with on the same basis, and yet gives an advantage to the consumer whose requirements can be provided at the lowest cost, is known as the two-part tariff system. Under this a fixed periodical charge is made, based on the capacity of the installation in proportion to the total capital charges of the undertaking, and a separate charge is made for energy actually consumed. In practice this results in a comparatively high overall charge per kWh consumed by those who only make intermittent use of their current-consuming devices, and a relatively low overall charge per kWh to those with a high average load. The equity of a two-part tariff is beyond dispute, and this system of charging has been approved by the Electricity Commissioners: Present tendencies are in the direction of its wider adoption. The two-part tariff introduces a new factor into the problem of meter design, as with a fixed charge based on the size of the installation and a low charge per kWh consumed, there is no *prima facie* necessity for differentiating in the price charged for lighting, heating, cooking or power; hence there is no necessity for more than one meter per installation. It follows, however, that a meter of sufficient capacity must be installed to be capable of recording the whole of the load, and it is equally essential that this meter should record accurately the low load which is taken when only the lighting load is on—or possibly only a few lamps.

Fig. 1.

Fig. 2.

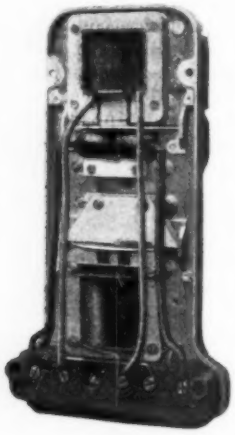


Fig. 3.

The Rent Meter, with and without Cover.

The existing state of the art of meter design is such that there are numbers of different types in existence which maintain a high degree of accuracy down to one-twentieth load, provided no frictional changes occur. Below one-twentieth load they fall away in accuracy to a varying extent for the following reasons:—

(1) The torque of a meter is proportional to the load, and the amount of power which it is permissible and practicable to utilise in the meter itself is limited; hence the available torque on low loads becomes infinitesimal.

(2) A minimum of friction has to be overcome in order to rotate the moving element and to drive the recording mechanism—apart from occasional extra friction due to extraneous causes.

It is apparent that as the load is reduced and the torque correspondingly diminished, the initial friction acquires an increasingly important influence. In alternating-current meters it is common practice to compensate for the initial friction by imparting a rotational tendency to the moving element at no load. When this method is used, great care has to be taken to prevent "creeping" or "shunt running," and some supply authorities impose backward-running tests in order to detect the amount of compensation which the manufac-

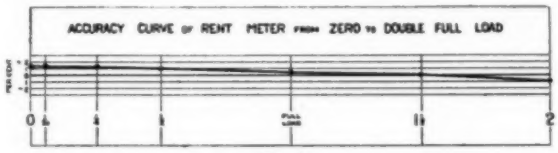


Fig. 4.

turers have had to resort to in order to make up for bad design or manufacturing deficiences. Notwithstanding improved accuracy on low loads due to compensation, it still remains a fact that, say, a 100-A meter would not be reliable for the accurate measurement of loads of the order of 1 to 5 A. Yet with a two-part tariff and a single meter, conditions of this sort are likely to be common.

These considerations led to the development of the "rent" meter, fig. 1. The basic principle involved is to run the meter continuously at no-load, at a sufficient speed to overcome the friction of the moving element, the gear, and the recording mechanism, and to do this in a positive manner with sufficient torque to ensure a constant no-load speed. If the meter is already running at a definite speed in a positive manner at no load, it follows that any load which may be applied, however small that load may be, will be recorded accurately. The method by which the no-load rotation is obtained will be dealt with later, and for the moment it is only necessary to emphasise the positive nature of the no-load rotation, in relation to the normal speed under load, and the resultant accuracy of record (*a*) of the no-load rotation, and (*b*) of the additional rotation due to load. It will be conceded readily that if a meter is already rotating at a substantial speed, there is no reason why the addition of even so small a load as that of a neon lamp should not be accurately metered. With the "rent" meter this is literally the case, any load, however small, being recorded.

There remains to be dealt with the question of what happens to the registration on the meter dials of the no-load rotation. This can be dealt with in various ways, *viz.*:—

(1) With a two-part tariff the rotation at no-load can be calibrated to represent the fixed charge.

(2) The constant rotation can be made to represent a rental of any kind, or standing charges, or, in the case of high pressure measured on the low-pressure side, the transformer iron losses.

(3) In the case of free or assisted wiring and installation schemes, the no-load registration can be made to represent the hiring or hire-purchase charge.

(4) In the case of a flat rate, or if it is desired to charge separately for the kWh consumed as distinct from the fixed charge, the no-load rotation, being a constant factor, can easily be deducted from the meter reading.

For prepayment consumers to whom it is desired to apply a two-part tariff or free or assisted wiring, the "rent" meter with a prepayment attachment is the only satisfactory solution. As both the no-load rotation, which represents the fixed charge, and the rotation due to load are actuating the same spindle and recording mechanism, only one slot is required, and all the complications which would otherwise be present are eliminated. The rotation at no-load continues even if the absence of coins prevents current being obtained, and sufficient coins have to be inserted to defray the accrued rental charge before supply can be resumed.

The advantages claimed for the "rent" meter are:—

(1) Accuracy at all loads from 1/100th to double full load; hence in addition to the special purposes for which the meter is the only practical solution, it is particularly suitable for measuring bulk supplies and other important loads where accuracy on low loads is required.

(2) The high degree of accuracy is obtained without recourse to delicate mechanism or adjustments, and without adding greatly to the cost of the meter.

(3) Owing to the accuracy of the meter on low load, it is not necessary to have a large range of sizes—thus simplifying the stocking of meters.

(4) The low shunt loss of the meter can be included in the registration.

(5) A single meter provides all the elements of a scientific system of charging.

As will be seen from figs. 2 and 3, the movement consists of two aluminium disks mounted on a common spindle which connects with the counting mechanism. The upper disk with its driving and braking systems is in its main features a standard induction meter, and is complete with the usual speed, low-load and power-factor adjustments. The lower disk is actuated by a shunt coil which energises an asymmetrical iron circuit, so disposed as to produce rotation at a constant speed which, however, can be varied at will by moving its keeper laterally. This movement is accomplished from the front of the meter (see fig. 2) by means of a micrometer adjusting screw situated under the right hand magnet. As long as the meter is energised, the spindle is rotated by the lower disk at a predetermined constant speed, the torque at this speed being of a sufficiently high order to be ample for overcoming initial friction and maintaining the speed with accuracy. In these circumstances any current, however small, passing through the series coils of the upper element will increase the speed of the meter. Initial friction having been overcome by the constantly rotating lower element, the series magnet of the upper element can be run at a low density. The constant rotation due to the lower element and the low density in the series system give the meter a straight-line characteristic, fig. 4, from zero to 100 per cent. overload, and in the absence of mechanical or electrical defects, the accuracy from a commercial point of view may be described as absolute.

All the parts are mounted on a cast-iron faceplate which may be taken out of the meter case by removing two screws, thus permitting the closest inspection without disturbing any part or interfering with the calibration. The jewel, which is easily renewable, is inverted and carried in the hub of the lower disk; it rests upon a spring-seated renewable pivot. All the adjustments are of the micrometer type, and are operated by an ordinary screwdriver. The link between the current and pressure coils, which has to be removed for testing purposes, takes the form of a knurled screw which makes a positive connection. All ferrous parts of the meter are coated with cadmium by a special electrolytic process to prevent rust, no paint being used in the meter.

The following are the technical data for this new apparatus:—Shunt losses (both coils together), 3 W; series loss at full load, 0.6 W. Overloads up to 100 per cent. in current and 50 per cent. in pressure can be safely carried by the meter, and the accuracy is within 2 per cent. from 1/100th full load to 100 per cent. overload.

Patents 198,772 and 213,091 for this meter have been granted and others have been applied for.

D

The British Magneto Industry.

A Visit to the B.T.H. Works at Coventry.

A Press visit on September 22nd to the magneto works at Coventry of The British Thomson-Houston Co., Ltd., indicated to some extent the growth of that industry since the year 1914, prior to which the output was practically nil.

At the commencement of the war the B.T.-H. Co. was commissioned by the Government to manufacture a special magneto for aircraft engines. This work was concentrated at the factory in question, and during the war period no fewer than 40,000 magnetos of this type were produced. The development of the 4-spark polar inductor magneto at later stages further increased the company's activities in this direction. The demand for aircraft magnetos greatly diminished after the war, and attention was concentrated mainly on the production of magnetos for motor cars and cycles.

For preparing moulded insulating materials, which play a very important part in the magneto industry, the company has established one of the largest and most up-to-date installations in the country. The material is known as "Fabrolite," and it leaves the mould with such a highly-polished finish that no finishing operations are required. Fig. 1 shows a section of the moulding rooms, where hydraulically-operated and steam-heated moulding machines deal with the various "Fabrolite" productions.

The manufacture of all B.T.-H. magnetos is carried out at the Coventry works, which comprise two large factories at Lower Ford Street and Alma Street; both are well equipped with the most modern machinery, laid out to deal with an intensive magneto manufacturing programme on the "mass production" basis. The system of manufacture is designed to ensure the maximum possible efficiency of operation. Apart from the usual economical lay-out of machine tools, and minimum machining costs, this manufacturing organisation takes into consideration other important factors, such as synchronising the factory output with the future requirements of the sales department, and ensuring that the time for conversion of the raw material into the finished product is as short as possible.

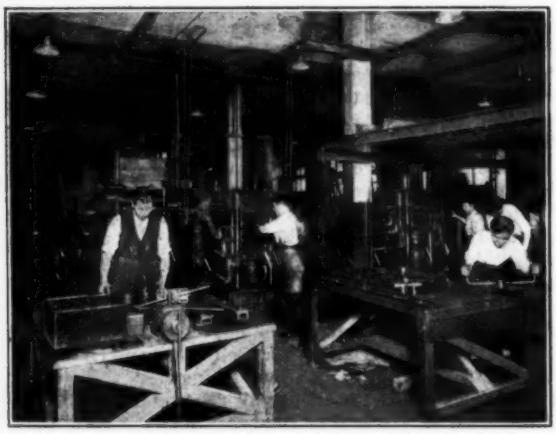


Fig. 1.—Moulded Insulation Department.

After a rigid inspection, and, where necessary, tests, the raw material passes through a main control station, where an indicator material control board gives information at any time as to the amount of material to be sent to any particular department for that week's work; any arrears of material, either from outside sources or inter-departmental; and a true record of replacements required to cover wastage. Each departmental head knows exactly the amount and rate of work required of him for a specified period, and, it should be mentioned, the work of the control station is carried out with a negligible amount of clerical labour.

The general efficiency of the operators has been closely studied from the health and psychological standpoints, and everything possible is done to create bright, cheerful, and healthy working conditions. In accordance with a definite colour scheme, the shops are painted pale blue and white, and all female operators in the assembly and winding departments, fig. 2, are provided with pale blue uniforms. In cases where it is necessary for the female operators to be seated, a special design of chair with adjustable back is provided.

The combined factories have a total floor space of about 4¼ acres. With the exception of the apparatus in the moulding department, all the machines are electrically driven, overhead group driving being employed in practically all cases.

Fig. 2.—Winding Department.

As we go to press we learn that B.T.-H. magnetos were used on the "Talbot" cars which took the first and second places in the 200-mile Junior Car Club race last Saturday.

The Average Man and his Lighting Installation.

(Communicated.)

At this moment, as a glance at the "Contractors' Column" in any issue of the Electrical Review will at once reveal, many hundreds of houses are being, or are about to be, erected. These are very largely of the middle-class type. For our present purpose, at any rate, we will ignore the "housing schemes" of urban district councils and other bodies which are trying to fill the demand for working-class dwellings, and confine our attention to the £800 to £1,200 (say) house of a type which is being built on "housing estates" by the hundred in and around London and provincial centres.

As soon as matters have been arranged with the estate agent, the future occupants begin to think about the internal furnishings of their newly-acquired habitation, and among those furnishings electric lighting fittings have to be included. Now, when they first viewed the house in its "lath-and-plaster" state, the highly-estimable couple saw those "love knots" of red and black wire beloved of the wireman protruding from the ceilings for pendants, and from ragged holes in the walls indicating the positions in which switches were eventually to be mounted. Whatever may have been their ideas in the past, and whatever may be their attitude towards other domestic fittings, there is no doubt whatever that to-day, and this is the crux of the whole matter, the average man and woman are absolutely convinced of their ability to choose for themselves their lighting fixtures, and even switch-plates, switch covers, &c., without any advice or assistance from contractor, dealer, or anyone else. Hence, leading manufacturers' showrooms are thronged with visitors who have come in "on their own" to look around at fixtures, shades, &c. Very often it is only the gentleman who visits, and, of course, he asks for

a catalogue "to show the wife." The chief point to remark here is that these visits almost invariably take place before a contractor has been seen about the wiring. A smaller point is that this method leads very often to the difficulty of having to refuse giving these people catalogues, which they always consider themselves fully entitled to, being ignorant of the rules adopted almost universally for trade regularity in the past. Moreover, manufacturers' catalogues are usually too costly productions to be given away broadcast in the mere hope that business may result.

The writer has frequently heard the remark made, "Oh, yes, we shall go to a contractor, but, of course, it's no use doing that until we know just what we want." In other words, the contracting fraternity has lost, or is rapidly losing, its consultative functions so far (and let it be borne in mind that these remarks are strictly limited thereto) as the installation of domestic lighting is concerned.

Another widespread conviction is that a lot of money can be saved by getting the fixtures, &c., oneself and then having them "fixed up" by any small jobbing man in the neighbourhood, rather than paying the "heavy charges" made by a contractor of repute and standing.

It will be well worth while for contractors to give these points their fullest consideration. The manufacturers' showroom is generally admitted to be fulfilling its function admirably as an "exhibition" whither contractors and dealers can send their clients to make selections on their account, and no allegation is ever made that manufacturers are not loyally supporting trade interests in the matter of reservation of discounts and other trade considerations. On the other hand, the public mind has unquestionably changed, so that without pointing the finger of blame at any section of our industry, it must be admitted that at this date the conviction is *there*, that by going to the "fountain head" first of all (this phrase is frequently used), better quality and better service are likely to be obtained than by consulting either contractor or dealer.

Is the electrical contracting industry, or the section thereof interested in domestic installations, going to admit frankly this change of attitude on the part of the purchasing public—modifying its selling organisation and other arrangements accordingly—or is it going to endeavour to induce a reversion to the recognition of the necessity or desirability of expert guidance?

The choice must be made *now*. The motto of the National Register is *Experto crede!* " but at the moment the average man believes himself his own expert in most cases, whilst his amiable spouse has no doubt whatever on the subject!

In conclusion, mention should be made of the fact that there is already a class of contractor apparently content to allow the aforesaid state of mind on the part of the public to prevail. Visitors to showrooms sometimes say: "Oh, yes! I have seen Mr. So and So, but he said I had better come and get your catalogue (you give them away), and when I have made up my mind what I really do want, see him again and he will order it." It will be noticed that here there has been no pretence on the contractor's part to be able to advise what will be suitable for the style of apartment to be illuminated, or to possess any particular expert knowledge—to him (and his customer) apparently, the old rule of "You pay your money and take your choice" covers the whole matter. Is this to be the final attitude?

The Metallurgist and the Engineer.

More Intimate Collaboration between Them is Needed.

(Communicated.)

Many engineers have a *kind* of notion that the metallurgist is supposed to be able to help them. Many metallurgists know that their work is expected to be in some way of direct and practical value to the engineer. Few, however, realise as they should how intimate should be their association, how great is their dependence upon each other, and how potent their powers once they pool resources and effectively co-operate.

It is unquestionable, of course, that the well-considered, adequately informed, carefully organised practical aid of the commercial metallurgist is of the utmost value to the engineer. It is no less unquestionable that the metallurgist, if he would make his contribution the boon which conditions and requirements warrant, must study and master the practical implications involved. As a person apart, a vendor in something sacrosanct, he is useless to the engineer. He has the direst need to visualise the essentially practical demands the engineer has upon his scientific training and ability.

That the collaboration between metallurgist and engineer is less—much less—to the fore than the importance of the matter suggests is partly the fault of each. Such collaboration is more than desirable—it is vitally necessary. While the former, often failing to understand certain of the highly important incidentals involved in commercial as distinct from laboratory production, thereby seriously restricts his usefulness, many of the latter are all too prone to dismiss the whole business out of hand as so much high-brow foible. This is most regrettable. Things are, however, nowadays considerably better than they were. What was characteristic of perhaps the majority in pre-war years is becoming increasingly recognised as an anachronism to-day.

The engineer is becoming more and more aware of his dependence upon the metallurgist; and he of the foundry is in like case. The metallurgist, on his part, is more fully alive to the fact that it is up to him to justify his existence as an expert in commercial employ appointed to apply his specialised knowledge to essentially practical uses. He now understands, as never before, that he must bring himself to function along the plane of workshop and ordinary commercial conditions. Thus, he has to familiarise himself with much of the technique of the foundry ere he is really in a position to help and direct as he should. In him theory and practice must not be in any sense opposites; he must exemplify both. He needs to be sufficiently master of the practical man's point of view to assist the practical man to carry on intelligently and correctly. So doing, he ensures that his own contribution shall be of the highest possible value. In addition—and this is as important an aspect of the case as any—he convinces engineer and founder that metallurgy is of first-rank practical importance. Some engineers, and not a few founders, need a lot of convincing. It is up to the metallurgist to make the matter so clear that "he who runs may read." Not till then will the prejudice of some be overcome.

Metallurgy is a fascinating science. Its methods, familiar enough to research workers in institution, university, technical college, and works' laboratories, are not nearly so well known or understood as they should be by the main body of engineers; nor are the results obtained, or the benefits derivable, sufficiently appreciated. Let the ordinary engineer know what metallurgy really can do for him, and many who are indifferent or wavering will become ardent converts. Its effects, as applied to the arts of the foundry and forge, are what the engineer is principally concerned with. Show him to what extent improvements are obtained, and in what directions, and by what means, and he will at least attend. Once his interest is whetted, it remains for the metallurgist to convince him.

Now, as is well known, the metallurgist, in contributing his quota, employs two distinct methods. He produces, and he examines what he produces. Thus, there are apparatus and processes peculiar to both the synthetic and the analytic method. The technique has been brought to such a pitch of excellence that the results from the one, and the interpretation possible by means of the other, are extraordinarily reliable and accurate. In addition, the analysis is often so complete that much can be deciphered concerning the treatment accorded to the body from which the specimen has been cut and prepared. Metallurgy has built up experimentally a mass of first-hand, accurate data respecting various gradings and groupings of metals and alloys. Particularly is the record a full one as regards the ferrous materials, and much has been done—though the field is almost limitless—in connection with non-ferrous alloys. What results are definitely established are reliable. This is the glory of the method, it not only ensures correct mixing, according to carefully measured weights, but it also secures the regulation of heat treatment throughout by reference to recording instruments of extreme delicacy and precision. The latter is no whit less important than the former. Thus, knowledge of the metals and alloys produced proceeds apace; and ability to reproduce any and every variety already won follows as a matter of course. The other method has its equally glorious trophies. The microscopical examination of most skilfully treated, carefully prepared surfaces has provided a medium for interpretation of almost uncanny thoroughness. The composition, certain of the general mechanical qualities, the distribution of segregated material, can be determined therefrom; and also it is possible to deduce the heat treatment to which the material has been subjected.

A leader entitled "Knowledge Gained of Metals by Aid of the Microscope" appeared in the August, 1925, issue of the *General Electric Review* (U.S.A.). Quoting therefrom, we read: "With the microscope we can determine with an almost unbelievable degree of accuracy the chemical composition, hardness, and mechanical and heat treatment a specimen has received, and also the segregation which has taken place. From these data many of the mechanical properties can be predicted, and the suitability of the material determined. In fact, a carefully performed microscopic examination will often solve a perplexing problem with a resulting increased production and elimination of waste due to faulty or improper treatment during any part of the manufacturing process."

Perhaps the most striking illustrations one could instance are those collected and reported upon in the Technical Reports of the British Engine, Boiler and Electrical Insurance Co., Ltd. The microscope is part of an inspector's normal kit, and the expert aid of the metallurgist is constantly pressed into service. This is highly significant. Insurance companies of standing, whether for life, property, or machinery, are rightly placed in the forefront of industrial investment securities; and are justly renowned for their careful, conservative, essentially sane and sound policy. Their actuarial estimates are surprisingly near the mark, and almost invariably such slight variations as occur err well on the right side. The insurance company may be trusted to effect a sound deal. The company's own end of the business will not suffer—that is well seen to. Now, when a leading insurance company finds it, to say the least, excellent policy to make extensive use of the means and methods of metallurgy, that is highly significant. The engineer should certainly take due note of that most significant fact. More, he should read the Annual Technical Reports of the Insurance Company just mentioned, particularly those for 1924 and 1925, the latter of which was recently issued. He will find in those reports instance after instance of the inspection of a specimen having revealed this, indicated that, shown what has been done here, and what has occurred there. In many cases occasion has been taken to point out how certain defects might have been, and should have been, obviated; and most valuable practical advice as to procedure and technique has been proffered. The recommendations made are invariably practical, but are at the same time strictly in keeping with ascertained and verified research—research in most cases undertaken by the company's own highly qualified metallurgists in the company's well equipped laboratories. Microscopic examination showed in one instance that the forging of a shaft "had been completed at too high a temperature, resulting in an excessive grain size. The material also contained areas of segregated impurity, the magnitude of these being sufficient to assist the setting-up of cracks." In another case when a specimen was etched, the cause of the trouble at once became apparent. Here "the material had been grossly overheated," and "the structure had been ruined by the annealing treatment having been most improperly carried out in a tinplate furnace. The treatment, instead of annealing the material, did the reverse." This particular failure called forth the caustic, but wholly justifiable, comment that "the company cannot too strongly condemn the heat treating of bolts, shafts, &c., by these rough and ready methods." Then follow very full and considered recommendations as to the correct treatment suitable for restoring such articles as are referred to. Another highly significant example is that where microscopical examination showed a generally clean steel to contain certain areas of segregated matter of appreciable size; also a totally incorrect state of heat treatment, the grain size being far too large. Here, the report adds, "the steel would have both a low elastic limit and poor qualities for resisting shock," also "if this shaft had been suitably heat treated after being forged, the structure would have been rectified, and the failure probably averted." These instances are taken from the Report for 1924 (published in 1925).

The Report recently published (that for 1925) follows broadly on like lines to its immediate predecessor. A highly important feature, however, is the publication of photo-micrographs comparing faulty structures with those resulting from suitable heat treatment. Several examples are given. These should appeal specially to such engineers as needs must see ere they will believe. Many bolt absurdities still persist, and such as come up for examination receive their full and deserved measure of censure. Faults of design, such as the emission of suitable fillets; faults in heat treatment, due to the haphazard methods too often deemed passable, are brought into the searchlight. Specially to the point is the case of a most unsatisfactory bolt, annealed in a fashion by a blacksmith, being compared with a similar bolt, this time correctly heat treated by the company's own metallurgist. The resulting refined structure of the latter, by comparison with the large, coarse grain of the grossly overheated original specimen, is so palpably superior that the inference is obvious. No wonder the Report makes direct reference to these annealing monstrosities. Among other instances, figure those of turbine disks, turbine blading, gas-engine crankshafts, boilers, and the like.

All these examples, and many others, go to show of what great and direct value the methods of metallurgy are to engineering generally. Metallurgy is no dead language, but a live and progressive science with a very definite and specific contribution to make. The associated arts of founding and forging will advance, largely as they, too, step into line. Engineer and metallurgist are cousins german; as right hand to left, as thumb to fingers, so are they each to each.

National Association of Supervising Electricians.—The new session will be opened on Tuesday next, October 5th, when the president of the Association, Mr. A. M. Sillar, M.Inst.C.E., M.I.E.E., M.I.Mech.E., will deliver his presidential address at the Junior Institution of Engineers, London. The chairman of the N.A.S.E., Mr. E. North, M.J.Inst.E., will preside, and will be supported by Mr. J. S. Highfield, M.Inst.C.E., M.I.E.E., and Mr. A. H. Dykes, M.Inst.C.E., M.I.E.E., ex-president. One of the first items will be the presentation of certificates by Mr. J. S. Highfield to the winners of prizes in the various competitions of the Association in the years 1923, 1924, and 1925.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Manchester Civic Week.—Next week is Civic Week in Manchester, and judging by a programme which has been sent us it will represent an unprecedented communal effort to make the city known not only to outsiders but to the citizens themselves. Many important industrial establishments are being thrown open to public inspection. The Corporation is encouraging visits to its electricity and gas works, the tramcar sheds and repair works and other departments, while among the private concerns whose works will be open to view are the Metropolitan-Vickers Electrical Co., Ltd., Messrs. Richard Johnson, Clapham & Morris, Ltd., Messrs. Mirrlees, Bickerton & Day, Ltd., and Superheaters Co., Ltd. There is to be a "Pageant of Industries" during the week, and among the electrical firms which will be represented are Messrs. Allen-Liversidge, Ltd., the British Thomson-Houston Co., Ltd., Ferranti, Ltd., the Chloride Electrical Storage Co., Ltd., W. T. Glover & Co., Ltd., Matthews & Yates, Ltd., Mather & Platt, Ltd., and the Metropolitan-Vickers Electrical Co., Ltd.; the Corporation Electricity Department will also have a display.

A.T.M. Cricket Match.—The final match of the Automatic Telephone Manufacturing Co.'s cricket knock-out competition, played on the Wavertree C.C. Ground on September 18th, in real cricket weather, resulted in a victory for Special Orders (Department 18) over the Tool Shop.

Unemployment.—There was a decrease of 7,635 in the number of registered unemployed during the week ended September 13th. The total at that date, excluding persons who ceased work on account of the coal dispute, was 1,551,900, as compared with 1,559,535 on September 6th and 1,327,637 on September 14th, 1925.

Employment during August.—The September *Ministry of Labour Gazette* says that unemployment in the engineering industry during August remained bad and, in fact, was rather worse than in the previous month. The position of the electrical engineering branch, however, showed a slight improvement. In this branch the proportion of unemployed fell from 8.5 per cent. in July to 7.9 per cent. in August; it was still well above the August, 1925, figure of 5.5 per cent. In the electrical wiring and contracting industry the proportion of unemployed rose from 11.9 to 14.9 per cent. There was a slight decrease in unemployment in the electrical cable, wire and electric lamp manufacturing group—from 7.7 to 7.4 per cent. In both cases the percentages of unemployed were above those in the corresponding month of last year.

Deed of Assignment.—J. P. HARTLEY, electrician and wireless salesman, 16, Dodworth Road, Barnsley.—Last day for claims October 11th. Trustee, Mr. W. Carr, 27, Regent Street, Barnsley.

Lead.—Messrs. James Forster & Co., reporting on September 24th, state:—"The future is obscure. Continental demand shows no signs yet of waking up, and consumption in this country is being hindered by the difficulty of obtaining coal supplies. Arrivals, on the other hand, are not in excess of the present moderate requirements of the trade, so that it would appear that supply and demand at the moment are pretty evenly balanced."

The E.D.A.-E.L.M.A. Campaign.—In connection with the "better home-lighting" campaign of the British Electrical Development Association and the Electric Lamp Manufacturers' Association, a meeting of members of all sections of the electrical industry in the Halifax district was held on September 22nd at the showrooms of the Corporation Electricity Department. Mr. W. M. Rogerson, borough electrical engineer, presided, and the meeting was addressed by Mr. H. Girdlestone, Yorkshire and Lincolnshire district officer for the scheme. A representative local committee was afterwards formed.

Ban on Special Illuminations.—Despite the ban of the Ministry of Mines on the use of lighting for display and advertisement, several towns in the north propose to proceed, or are proceeding, with schemes of special illumination in connection with civic celebrations. The Manchester *Daily Dispatch* reports that Manchester Corporation proposes to proceed with its programme of illumination. A Corporation authority states that foreign coal is being bought and that the electricity consumed for this purpose will be negligible as compared with the daily consumption. Liverpool Corporation is of the opinion that the Board of Trade will allow extra illumination for its Civic Week, as there is no shortage of coal. Blackpool Town Council's autumn festival commenced on September 25th, and over 250,000 electric lamps are in use. The illumination scheme at Southport has been cancelled.

Information for South Africa.—Mr. C. E. Scott, dealer in electrical and mechanical engineering supplies, 72, Bree Street, Cape Town, requires information from actual manufacturers regarding domestic electrical appliances, such as ironers, washing machines, &c. He is particularly desirous of obtaining good British electric stoves to compete with American patterns.

American Loan to German Electrical Industry.—A *Reuter* dispatch from New York reports that definite arrangements have been made in connection with the $24,000,000 loan to the Siemens group in Germany, which, it was expected, would be put on the market on Friday last as 6½ per cent. debenture bonds, taking the form of 50 per cent. paid allotment certificates. A substantial portion of the bonds had been withdrawn to be offered in Europe, in addition to which Reichsmark bonds totalling about $6,000,000 are to be put up for sale in Germany on substantially similar terms.

The *Financial News* says that an amount of $2,500,000 was offered privately in London and Switzerland. It is understood that applications received in London alone were much in excess of the amount available for allotment.

French Electrical Imports and Exports.—The appended table shows the French imports and exports of electrical machinery and apparatus during the six months ended with June last, as compared with the corresponding half of 1925. It will be gathered from the figures that while the imports showed an increase of about 27 per cent., there was an advance in exports of just over 72 per cent.

	Imports. Jan.-June,		Exports. Jan.-June,	
	1926.	1925.	1926.	1925.
	1,000 fr.	1,000 fr.	1,000 fr.	1,000 fr.
Electric insulators of porcelain, &c. ...	1,079	1,802	8,658	3,536
Incandescent lamps, with holders ...	24,333	24,000	26,871	16,935
Incandescent lamps, without holders ...	772	720	—	—
Dynamo-electric machinery weighing over 20 cwt. ...	8,784	13,325	—	—
Dynamo-electric machinery weighing between 1 & 20 cwt	7,606	4,430	56,447	30,564
Dynamo-electric machinery weighing less than 1 cwt.	13,707	8,079	—	—
Electrical and electro-technical apparatus	38,163	25,047	148,113	85,090
Dynamo and motor frames and casings	156	85	3	27
Electric wires and cables	5,298	3,439	11,480	8,371
Dynamo-electric armatures	13,442	8,571	19,154	12,358
Electric accumulators	3,597	2,615	8,668	5,255
Dry batteries	140	53	1,744	1,193
Totals ...	116,987,000 fr.	92,166,000 fr.	281,147,000 fr.	163,329,000 fr.

N.A.R.M.A.T.—Messrs. Derbyshire & Co., chartered accountants, 4, Southampton Row, London, W.C.1, have been instructed to prepare a statement of affairs of the National Association of Radio Manufacturers and Traders as at September 30th in connection with proposals for reconstruction. Creditors are asked to forward claims, &c., by October 7th.

Local Exhibition.—BIRMINGHAM RADIO SHOW.—The Birmingham and Midlands Wireless Exhibition will open on October 5th and will last until the 16th. A large number of local and national firms have taken space, and special features will be a broadcasting studio in the Exhibition Hall, in which a section of the staff of the Birmingham broadcasting station will transmit programmes daily, and a competition, open to amateur constructors, in which prizes to the value of £100 are offered for the best crystal and valve receivers.

Catalogues Wanted.—MESSRS. MELLOR & Co., who have taken over showrooms at the Central Hall, Scunthorpe, Lincs., wish to receive manufacturers' lists.

Electricity Supply Wages.—Mr. C. Wragg, secretary of the Electricity Supply District Council (No. 2) Yorkshire, North Lincolnshire, North Nottinghamshire, and North Derbyshire, issued a notice last week to the following effect. Under Clause 5 of the terms of settlement adopted by the National Council on November 4th, 1921, the next wages revision should have taken place as from October 1st, 1926, based upon the average of the cost of living index figures as published in the *Ministry of Labour Gazette* in the three preceding months. The figures are:—July, 1926, 70 per cent. above the figure for August, 1914; August, 70; September, 72. The average of these figures is 70¾ per cent., which, if deducted from the datum figure of 120, leaves 49¼ points, or eight cycles of six complete points. There have been eight variations (net) to date; there will therefore be no change in the rates of the grades set forth in the schedule of rates of the District Council, as from October 1st. This notification applies also to all other districts which are parties to the National Agreement.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. report, September 28th:—Copper (electrolytic) bars, sheets, and wire rods, no change; h.c. wire, 9 9/16d., 1/16d. increase.

Messrs. James & Shakespeare report, September 28th:—No change in the prices of copper bars (best selected), sheet, and rod; English pig lead, £33 5s., 5s. decrease.

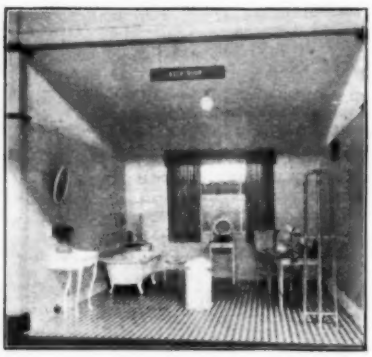
Messrs. Edward Till & Co. report, September 28th:—India rubber, Para fine, 1s. 8¾d., ¼d. increase.

New Italian Companies.—Among the new electrical concerns recently formed in Italy are the Società Lavarazioni Elettro-meccaniche, Milan, La Società Esercizi Elettrici Lazio-Sabina, Rome, capital 100,000 lire; La Società Idroelettrica del Speranto Ing Lapo degli Uberti & Co., Florence, capital 500,000 lire; La Società Electrica Frentana, Campobasso, capital one million lire; La Società Costruzione Apparecchi Termoelettrici, Brescia, capital 10,000 lire; and La Società Sgrassatura Elettrochimica Cascami, Milan, capital 30,000 lire.

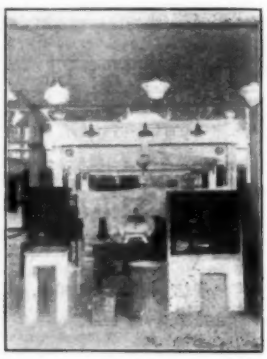
New Belgian Companies.—Among the new companies recently formed in Belgium are the Société Taspa de Téléphonie Automatique, Système Paul Anspach, Ixelles, the Société Manufacture Anversoise de Fils et Cables Electriques, Mortsel-Veux-Dieu, capital one million fr., and the Société Manufacture Générale d'Isolants pour l'Electricité Armand-Huart and Robert Coulon, Ecaussines-d'Enghien, capital 100,000 fr.

The Smoke Abatement Exhibition.—We reproduce herewith photographs of part of the joint display in this exhibition that was organised by the City of Birmingham Electric Supply Department, the British Electrical Development Association, the Walsall, West Bromwich, Wolverhampton, Worcester, Stafford, and Sutton Coldfield electricity undertakings, the Stratford-on-Avon Electricity Co., Ltd., the Shropshire, Worcestershire, and Staffordshire Electric Power Co., Ltd., with its subsidiary companies, the Kidderminster and District Electric Lighting & Traction Co., Ltd., the Halesowen Lighting & Traction Co., Ltd., the Tewkesbury Electric Lighting Co., Ltd., and the Ludlow Electric Lighting Co., Ltd. The exhibition, as reported in our issue of September 10th, was held in Bingley Hall, Birmingham, from September 6th to 18th, and was attended by large numbers of residents, architects, doctors, builders, manufacturers, and other persons in the Midlands, interested in the reduction of the smoke evil. A valuable feature of the exhibition was a series of four lectures given by Mr. G. S. Francis, of the British Electrical Development Association, on the influence of electricity on health, healthy cities, the home, and the factory. The exhibition and lectures will no doubt prove to have stimulated electrical development for all purposes in Birmingham and the Midlands generally.

Kitchen.



Bathroom.



Industrial.

Joint Display at the Smoke Abatement Exhibition.

What did Mother Say?—We are indebted to a correspondent in India for the following choice specimen from his postbag :—

Please take care this card.
4th.....1345. 14th August, 1926.
Time 10¼ o'clock.
I wrote this without book.

I want to inform you that I write on card place or as I know english. I am thought many or some times to burn electric for more to less and for less to more and what is cause for that and why is if careless for the bill and then if they are doing applier again and they can not get cause. As of now bill of ..... is showed for much and he is living in ..... with family and house is almost closed. until in last month I was out. Please you will try to get less money from meter, or you will write on this addressed with name or my name. Which is house No. ..... But write near ago of side rooms of leading beside round at door.

Perhaps I was given my Printed thing at your office.
His mother said for the bill.

Yours f,full,
Sd/ .....

Popular Electrical Talks.—A series of free popular talks has been arranged for Tuesday evenings between November 2nd and February 22nd, at the Hackney Electricity Department Demonstration Halls. The range of the subjects is wide, and the electrical speakers include Messrs. L. Gaster, W. J. Jones, G. S. Francis, V. W. Dale, J. R. J. Bowden, and W. E. Bush. There is also to be a Hackney radio week, when there will be a lecture arranged by the B.B.C.

Proposed Austrian Agreement.—It is reported from Vienna that, following the example of Germany, efforts are being made to bring about some agreement between the leading electrical engineering concerns in Austria, with the object of avoiding unnecessary competition, especially having regard to the present low level of prices.

Trade Announcements.—Messrs. Radio Instruments, Ltd., have appointed Mr. G. H. Stevenson, of 40, Union Street, Glasgow, as their representative for Scotland as from September 20th.

The Kensington and Knightsbridge Electric Lighting Co., Ltd., is to-day removing to Pelham Street, London, S.W.7.

The Becco Engineering & Chemical Co., Ltd., has removed to Fitzalan House, Arundel Street, Strand, W.C.2. Telephone: Central 8317; telegrams: "Engichemco, Estrand, London."

Catalogues and Lists.—Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C.2.—Leaflet No. 1.059, illustrated, descriptive of type Mg.1 general utility wave-meters.

Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15.—New showcard, No. H2, measuring 20 in. by 15 in., in seven colours, advertising batteries for motor-car starting and lighting.

Messrs. A. H. Hunt, Ltd., Tunstall Road, Croydon.—List of "Sunlite" electric hand lamps. Twenty-four of these lamps, employing Hellesen dry batteries, were used on the airship *Norge* during Captain Amundsen's transpolar flight.

Messrs. Herbert Morris, Ltd., Loughborough.—32-page illustrated catalogue of time-saving slings for various classes of loads, sling accessories, electric hoist blocks, pulley blocks, &c.

Normand Electrical Co., Ltd., 3, North Side, Clapham Common, London, S.W.4.—Priced leaflet, giving an illustrated description of their "Neco" battery charging set.

Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, London, W.C.1.—36-page catalogue of new receivers and components for the current season.

Messrs. A. C. Scott & Co., Ltd., 89, St. James' Street, Manchester.—Revised list (40 pp.), giving prices and technical data concerning high-grade electrical resistance alloy wires and tapes.

Dubilier Condenser Co. (1925), Ltd., Victoria Road, North Acton, London, W.3.—28-page catalogue, fully illustrated, dealing with the invention and manufacture of the Dubilier condenser and particularising, with prices, these condensers and other products.

The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, London, E.C.4.—Folder giving prices of various types of electric lamps for domestic service; folder detailing and illustrating the "Swanlite" dustproof lighting fitting for store lighting; 16-page booklet, "Illumination and Eyestrain," containing notes on the effect of artificial lighting upon the human eye; also a 20-page pamphlet, "Night Driving," discussing lighting for motor cars and particularising the company's automobile lamps for headlight and general service. Illustrated and priced 18-page guide to data of valves now available for distribution to the public by dealers.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, London, E.C.4.—Catalogue No. 153 (16 pages) containing illustrated descriptions of new shop-window lighting reflectors, spotlight projectors, "Linolite" strip, signs, &c.; 16-page domestic appliances booklet, relating to "Siemens-Xcel" electric irons, fires, kettles, &c.—space is left for overprinting with the trader's name.

Messrs. Houghton-Butcher (Gt. Britain), Ltd., 88-89, High Holborn, London, W.C.1.—New editions for the season of their various catalogues for dealers in radio apparatus have been prepared, and the different designs of these are brought together in a special brochure, so that the dealer may choose whichever he likes upon which to print his name.

The Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10.—Trade price folder of Saxonia flexible cords. We have also received samples of braided asbestos flexible cord which the company has manufactured for many years.

The Ormond Engineering Co., Ltd., 199-205, Pentonville Road, King's Cross, N.1.—A well-illustrated and priced catalogue of variable condensers of various patterns, filament rheostats, l.f. transformers and other radio components; and a full range of B.A. and Whitworth screws.

BRITISH INSULATED CABLES, LTD., Prescot.—Leaflet No. P204 (replacing another), giving a description of a new method of rendering armoured cables corrosion proof; No. P203 is a 20-page illustrated catalogue of "Prescot" mining boxes.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Playhouse Yard, Golden Lane, E.C.1.—An illustrated catalogue of "Lewcos" inductance coils, aerial wires, battery leads, and other radio materials. Also a pamphlet describing "Lewcos" screened coils and transformers.

SWEDISH GENERAL ELECTRIC, LTD., 5, Chancery Lane, W.C.2. —Stock List No. 117, containing particulars and prices of d.c. dynamos and motors and a.c. motors, printing press equipment, starters, &c.

MESSRS. NEWTON & WRIGHT, LTD., 471-473, Hornsey Road, N.19.—An illustrated price list of galvanic and faradic batteries, sinusoidal apparatus, heat and light baths, vibrators and other electro-medical apparatus.

MESSRS. S. GUITERMAN & CO., LTD., 35, Aldermanbury, E.C.2. —A folder advertising the "Adjusto-Lite" electric lamp, which is now available in five finishes, *viz.*, satin brass, white enamel, nickel, bronze, and oxidised silver.

MESSRS. JOHN BENNIE, LTD., Moncur Street, Glasgow.—*Correction.*—The reprint referred to in our last issue deals with the company's lifts, not "lists," as stated.

Bankruptcy Proceedings.—WILLIAM WHITE, The Shielding, Broad Lane, Whoberley, near Coventry, wireless and electrical supplies factor.—The first meeting of creditors was held on September 20th at the Official Receiver's office, 9-11, High Street, Coventry. The statement of affairs showed liabilities of £990, against assets of £33, leaving a deficiency of £957. Debtor attributed his failure to bad trade, and depreciation in value of wireless stock. It appeared that he commenced business as a factor in electrical supplies at Coventry, in October, 1921, with a capital of about £100, and in addition an advance of £100 from another. Debtor explained that it was intended that the latter person should join him in partnership, but no agreement was actually entered into, and in about two months the gentleman left him and treated the £100 as a liability of the debtor. The amount was still outstanding. As from March, 1922, debtor conducted the business, then mainly in wireless accessories, from his residence. He had been aware of his position since 1922. The case being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Cleartron Radio, Ltd. ...	... 225	Roberts, R.	... 22
Cable Accessories Co., Ltd.	... 32	Seasons, Ltd.	... 32
Forum & Co.	... 40	Smith, F. J.	... 25
Hestavox, Ltd.	... 117	Van Raden & Co., Ltd. ...	... 200
Morris, J. R.	... 22	Wineberg & Co.	... 230
Metro-Vick Supplies, Ltd.	... 117		

RICHARD HAMPSON, Yew Tree Bungalow, Hall-i'-th'-Wood, Astley Bridge, Bolton, electrical engineer, lately 28, Victoria Square, Bolton.—The public examination was held on September 21st, at Bolton. The statement of affairs showed liabilities of £207, with a deficiency of £194. It appeared in 1922, debtor commenced business in partnership; his wife advanced him £20 capital. In January, 1925, he withdrew from the partnership, receiving no payment as his share in the business, but he had been sued by creditors of the partnership. The examination was closed.

H. MILNES (H. Milnes & Son), plumber and electrical engineer, 6, Trinity Street, Huddersfield.—First meeting held September 28th. Public examination, November 15th, at the County Court House, Huddersfield.

J. A. A. BARDSLEY, electrical contractor, 91, Old Hall Lane, Withington, Manchester.—Last day for proofs for dividend October 9th. Trustee, Mr. J. G. Gibson, Senior Official Receiver, Byrom Street, Manchester.

H. L. WOOD, electrical engineer, 7, Taswell Road, and late of Elm Grove, Southsea.—Last day for proofs for dividend October 12th. Trustee, Mr. H. Ashton, 87, High Street, Portsmouth.

G. MASON and G. E. TINSLEY (Mason & Tinsley), electrical engineers, 6, Alberta Terrace, Sherwood Rise, and 94, Upper Parliament Street, Nottingham.—First meeting held September 30th, at the Official Receiver's office, 4, Castle Place, Nottingham. Public examination, October 7th, at the County Court House, Nottingham.

A. NORTH and F. NORTH (A. & F. North), wireless and electrical engineers, 38, Bradford Road and Market Place, Dewsbury.—First and final dividend of 1s. 0½d. in the £, payable at 16, Bond Street, Dewsbury.

Company Liquidations.—GENERAL ELECTRIC TRAMWAYS CO., LTD.—A meeting of members is called for November 1st at 88, Kingsway, W.C., to hear an account of the winding up from the liquidators, Messrs. T. Bower and H. W. Davis.

WESTERN WIRELESS TELEPHONES, LTD.—A meeting of members is called for October 27th at 20, North John Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. W. J. B. Kempton.

Dissolutions of Partnership.—READ & MORRIS, wireless and electrical engineers, 31, East Castle Street, Oxford Street, W.1.—Mr. F. O. Read and Mr. A. E. Morris have dissolved partnership. Mr. Morris will attend to debts and continue the business.

FRANKLIN & HARGREAVES, automobile electrical engineers and factors, Fisher's Yard, Meadow Lane, Leeds.—Mr. C. E. Franklin and Mr. G. B. Hargreaves have dissolved partnership. Mr. Hargreaves will attend to debts and continue the business under the same style.

For Sale.—Mr. H. J. Shaw will sell by auction, on October 14th, at 13, High Holborn, W.C., at 11 a.m., a quantity of new Fuller accumulators, loud speakers, receiving sets, &c. Portsmouth Corporation Tramways Department invites offers for surplus steam and electrical plant installed at the Tramway Power Station, Vivash Road. Messrs. Penningtons, Ltd., will sell by auction, on October 13th, at 414, Richmond Road, Richmond, the stock of a wireless contractor, &c. (See our advertisement pages to-day.)

Book Notices.—"Simple Facts About Electricity for Home and Factory." Second edition. By Harry Webber, M.I.E.E. Pp. iii+102. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. Price 1s. 9d. net.—This is a suitable little book for those desiring a practical treatise of the subject in simple technical language. It is written in 14 chapters, dealing with electrical terms, installation work, appliances and wireless. In addition there are several useful tables giving such data as motor loadings and wire gauges.

The British Aluminium Co., Ltd., has recently issued its Booklet No. 192, which contains a great deal of information relating to aluminium bus-bars and connections for power stations. The metal is compared with copper throughout and the publication includes a number of illustrations of actual installations.

"Quarterly Bulletin of the Institution of Engineers, Australia." Vol. III, No. 11, July 31st, 1926. Published by the Institution.

Transactions of the South African Institute of Electrical Engineers." Vol. XVII, Part 7, July, 1926. Johannesburg: The Institute. Price 2s.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLV, Part 9, September, 1926. New York: The Institute. Price $1.

We have received from the New York Edison Company a set of eleven booklets which reproduce a series of talks broadcast from "WJZ," New York. These deal with various phases of the company's activities in a very interesting manner.

"Regelung und Ausgleich in Dampfanlagen," by T. Stein. Pp. viii+389. Berlin: J. Springer. 30 Reichsmarks.

New French Companies.—Amongst the new companies recently organised in France are the Société de Distribution Electrique du Canton de Boissy-St. Leger, Paris, capital one million fr., the Compagnie d'Etudes et de Recherches Electro-Agricoles, Paris, capital 700,000 fr., and La Société Française de Fer Electrolytique, Paris, capital 2,250,000 fr.

China from the Engineer's Point of View.—This is the title of a lecture that is to be delivered at the Junior Institution of Engineers, 39, Victoria Street, S.W., on October 15th, at 7.30 p.m., by Mr. R. L. Sarjeant, B.Sc.

The Rutenberg Scheme.—It is reported that the Palestine Electric Corporation, Ltd., which was formed to work the concession granted to Mr. Rutenberg for the supply and distribution of electricity in Palestine, has raised £950,000, and the preliminary work is to be commenced shortly. Lord Reading, Sir Hugo Hirst, Sir Alfred Mond, and Mr. James de Rothschild have agreed to join the board of the company. The concession is for a period of 70 years, and the bulk of the constructional work is expected to be completed in five years. One feature of the scheme is the development of hydro-electric power from the Jordan. Special privileges are being accorded the company during the constructional period.

E.D.A. Conferences.—The first of the London conferences of the Electrical Development Association for the 1926-27 session takes place on Friday, October 15th, at the Royal Society of Arts, when Mr. V. W. Dale will speak on "Wiring the Homes of Britain." We shall print the programme for the session next week.

Commercial Travellers and Salesmanship.—Commercial-traveller readers of the ELECTRICAL REVIEW are invited by the National Union of Commercial Travellers to attend a meeting at the Manchester Hotel, Aldersgate Street, E.C., on Friday, October 8th, at 7 p.m., at which there will be a discussion on "Schools of Salesmanship—Are they Advantageous to Commercial Travellers?" The question which interests commercial travellers is whether such schools can be of service to men on the road, or whether they merely encourage a flood of new entrants whose efforts to gain employment depreciate the status and remuneration of commercial travellers.

Lighting and Power Notes.

Ayrshire.—YEAR'S WORKING.—The accounts of the Ayrshire Electricity Board (engineer, Mr. W. C. Bexon) for the year ended May 15th last, record a total revenue of £194,732, as compared with £168,968 in 1924-25. Working expenses decreased from £77,228 to £75,860, leaving a gross profit of £118,871, as against £91,740, to which was added a balance of £3,142 brought forward from the previous year, making a total of £122,013. Interest and special expenditure absorbed £71,361, and £48,587 was transferred to sinking fund, leaving a net profit, carried forward, of £2,065. The capital expenditure during the year amounted to £151,468, and included £80,876 for machinery and £56,173 for mains. The sales of

electrical energy increased from 25,780,564 to 27,531,654 kWh, and the maximum supply demanded from 12,500 to 14,200 kW. During the year a second 12,500-kW set and two 50,000-lb. boilers were put into commission. At the end of the year the total length of mains laid was 280 miles of underground cable and 121 miles of overhead lines.

Bristol.—Year's Working.—The report on the working of the city electricity undertaking (engineer, Mr. H. Faraday Proctor) for the year ended March 31st last, shows a total income of £466,222, as compared with £421,011 in the preceding year. Working expenses amounted to £256,582, as against £252,014, leaving a gross profit of £209,639 (£168,997), to which was added revenue from other sources, making a total of £224,825 available. Capital charges accounted for £129,255, and there was a net surplus of £95,570, as compared with £70,685 in 1924-25. This was disposed of as follows:—Capital expenditure charged to revenue, £15,049; sundry payments, £7,827; transferred to reserve, £56,694; rate relief, £16,000. The capital expenditure during the year amounted to £233,439, the chief items being £152,212 for mains, £26,868 for machinery, and £29,545 for buildings. The electrical energy sold increased from 56,082,891 to 64,183,737 kWh, and the maximum supply demanded from 26,348 to 30,893 kVA. The total revenue obtained per kWh fell from 1.64d. to 1.60d. Over 68 miles of additional cables was laid during the year, and good progress was made with the work in connection with the changing over of the single-phase system to 3-phase.

Callington.—Inauguration of Supply.—The electricity undertaking of the Callington and District Electric Supply Co., Ltd., was recently inaugurated, the chairman of the Urban District Council formally opening the power station and switching on the supply for the street lamps. The company states that 215 houses have already adopted electric lighting.

Cannock. — Mains Extensions. — The Urban District Council has sanctioned mains extensions at an estimated cost of £1,894.

Continental. — Sweden.—The new Government-owned hydro-electric power station at Norrforsen on the Ume River is now almost completed after two years' work, and the distribution of electricity from the station will begin in a few days. —*Reuter's Trade Service* (Stockholm).

Spain.—According to *Commerce Reports*, a Spanish firm with a capital of 10,000,000 pesetas has obtained the ownership of, and the right to develop, two waterfalls in the Alberche River which are capable of producing 50,000 h.p. The electricity produced will be used for irrigation purposes, the electrification of the Madrid-Avila and the Madrid-Segovia sections of the Norte Railway, and will furnish a supply for Madrid and its environments. The company is to complete the scheme within a period of five years. The Government will give financial aid to this project.

Italy.—A new hydro-electric power station has recently been completed at Ponte Fiume on the lower Liri river in Central Italy. The plant comprises two 4,500-kVA sets and one of 2,250 kVA. Energy is generated at 12,650 V, at which pressure it is transmitted to the transformer station at Ceprano, where there are installed two 2,000-kVA transformers, two of 10,000 kVA and two of 3,000 kVA. Work is also in hand on the construction of a second station, at Ceprano, to utilise the resources of the same river. The station is being designed to accommodate three 5,600-h.p. sets. It is expected that an annual output of 50 million kWh will be attained.

Dronfield.—Special Order.—The Urban District Council, on the suggestion of the Electricity Commissioners, has decided to apply for a Special Order, authorising it to distribute electricity in the town. Mr. I. Scott Mackenzie has been appointed electrical engineer and adviser in connection with the application. The Council proposes to obtain a supply of electricity in bulk from the Staveley Coal & Iron Co., and the probable charges will be: Lighting, 5d. per kWh; heating and cooking, 2½d. per kWh; power, 1½d. and 2d. per kWh.

Dunfermline.—Electricity in Small Houses.—It has been decided that electricity shall be installed in several of the Corporation housing schemes and schedules are being prepared for tenders.

Exeter.—Loan Sanctioned.—The City Council has received sanction to the borrowing of £25,000 for mains, services, transformers and switchgear. The city electrical engineer (Mr. H. D. Munro) reports that the foundations for the new turbo-alternator and for the new boilers are nearly completed, and those for the steel chimney and economisers will next be taken in hand.

Iraq.—Baghdad.—The *Financial Times* reports that the holders of the Baghdad electrical concession, Messrs. John Stone & Co., of London, have agreed to the amended clauses insisted upon by the Crown Agents and Colonial Office. It is understood that a company will be floated in London shortly with a capital of £250,000 to exploit the concession.

London.—Bermondsey.—The Electricity Committee reports that it has again considered the proposals contained in the reports submitted by Mr. Tapper following his inquiry into the Council's electricity undertaking. With regard to the suggested purchase of the distribution rights of the companies having powers in the borough, the Committee has been in communication with them, with the result that they are not prepared to dispose of their statutory powers to the Council. With regard to Mr. Tapper's proposals for the re-organisation of the domestic arrangements of the Council's undertaking, and the taking of bulk supplies, in view of the important provisions contained in the Electricity (Supply) Bill, now before Parliament, the Committee has decided to postpone further consideration of these matters pending the passage of that measure.

Southwark.—The Electricity Committee is to apply for sanction to a loan of £8,000 for electricity purposes.

Electricity Charges.—The County of London Electric Supply Co., Ltd., announces that, as and from the September quarterly readings, 1926, the reduction of 10 per cent., in the percentage increases which was given effect to as and from the March quarterly readings, will be withdrawn and the rates for supply will be those in force prior to the March quarterly readings, 1926. The company regrets that the increased cost of fuel and other supplies, and the dislocation of business resulting from the coal strike, have rendered it necessary to rescind the reduction of rates for supply made early in the year, but hopes that this will only be a temporary measure.

Lowestoft.—Loan.—The Electricity Committee has recommended to the Town Council that application be made for sanction to a loan of £53,000 for the extension of the generating plant.

Maidstone.—Year's Working.—The report on the working of the Corporation electricity undertaking (engineer: Mr. E. E. Hoadley) for the year ended March 31st last shows a total revenue of £94,912, as compared with £92,201 in the preceding year. Working expenses amounted to £62,673, as against £63,892, leaving a gross profit of £32,239 (£28,309). After meeting capital charges, there was a net profit of £10,764, as compared with £8,063 in 1924-25. The capital expenditure during the year amounted to £53,615, the chief items being £27,871 for machinery and £12,523 for mains. The electrical energy sold increased from 15,335,417 to 16,605,027 kWh, and the average price obtained per kWh fell from 1.42d. to 1.32d. The maximum supply demanded rose from 4,779 to 5,242 kW.

Market Drayton.—Street Lighting.—The Urban District Council has accepted the tender of the Market Drayton Electric Light & Power Co., for public lighting, until April 16th next, at £3 10s. per lamp.

Middlesbrough.—Inquiry.—*The Times* reports that the Electricity Commissioners intend to hold a public inquiry on October 12th into the proposal of the Corporation to erect a generating station at a cost of £131,800.

Nantwich.—Institution Lighting.—The Board of Guardians has adopted a recommendation to install electric lighting at the Institution at an estimated cost of £1,200, plus 10 per cent. for contingencies. It is proposed to take a supply of electricity from the North Wales Power Co., Ltd.

Newport (Mon.).—Proposed Linking-up.—According to the *Western Mail*, at a recent meeting of the Town Council it was decided to instruct the borough electrical engineer and the consulting engineer to prepare a report on the question of the possibility of linking up the power station with that of the Cardiff Corporation.

Padiham.—New Sub-Station.—The Town Council is to expend £12,400 on the erection of a sub-station. The Lancashire Electric Power Co. is to carry out the installation work, laying of cables, &c., and Messrs. Duxbury are to erect the transformer station.

Portsmouth.—New Plant.—The maximum load upon the Corporation's electricity undertaking has been increasing so rapidly that the installation of further generating plant has been decided upon, and it is proposed to install by the winter of 1927, another new turbine of 8,000-kW capacity and two additional 50,000 lb. boilers, the total cost of the extensions being estimated at £77,000. The present total capacity of the station, including plant on order and not yet at work, is 19,000 kW.

Preston.—Electricity Extensions.—The Corporation Electricity Committee has received sanction to the borrowing of £19,996 for additional boiler plant, £13,970 for mains, transformer kiosks and equipment, and £79,000 for mains, services, land and buildings, &c. The Committee has recommended mains extensions costing £2,200 in Pope Lane, Penwortham, £2,150 in the Ribbleton area, and £1,300 in the Frenchwood area.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

Aylesbury.—Domestic, business and power purposes: An increase of 10 per cent.

Birkenhead.—Electricity for all purposes: An increase of 10 per cent.

Bedford.—An increase of 10 per cent.

High Wycombe.—Electricity for all purposes: An increase of ½d. per kWh.

Hoylake.—Lighting: From 6½d. to 7d. per kWh.

Pudsey.—Electricity Supply.—The Town Council has received sanction to borrow £10,000 for the development of their electrical undertaking, including the conversion of the street lamps from gas to electric lighting.

Skipton.—Inquiry.—The Electricity Commissioners will hold an inquiry at the Town Hall on October 21st into the application of the Electrical Distribution of Yorkshire, Ltd., for powers to distribute electricity in several urban districts in

Craven, including Barnoldswick, Earby, and Silsden. The Commissioners will also consider applications from the three Councils mentioned for Special Orders.

Southampton.—Year's Working.—The report on the working of the Corporation electricity undertaking (engineer, Mr. W. G. Turner) for the year ended March 31st last, shows a total income of £188,620, and working expenditure of £112,215, leaving a gross profit of £76,405, to which was added a balance from the previous year of £2,279, making a total of £78,684. The figures for the preceding year were: Income, £173,654; working expenses, £111,002; gross profit, £62,652. Capital charges absorbed £48,309, and works of a capital nature charged to revenue amounted to £15,416, leaving a net surplus of £14,959. The capital expenditure during the year amounted to £89,448, and included £27,141 for machinery, &c., and £48,298 for mains and services. The sales of electrical energy increased from £17,909,256 to 22,204,271 kWh, and the maximum load from 10,064 to 11,680 kW. A supply to Eastleigh was inaugurated during the year, and the Portswood substation was put into commission.

Southend-on-Sea.—Proposed New Power Station.—The Town Council has decided, in view of the large capital outlay which would have to be incurred in the installation of the necessary plant, estimated at £238,000, not to accept the offer of the County of London Electric Supply Co., Ltd., for a supply of electricity in bulk from Barking. The Council is recommended to adopt the scheme for the erection of a new generating station at South Fanbridge at an estimated cost of £649,000. The Electricity Commissioners have asked if the Council is prepared to consider the question of affording a bulk supply of electricity to Burnham-on-Crouch and neighbouring parishes, and in the rural district of Maldon, for which a Special Order has been applied for. The Council has replied that it is considering proposals which might enable it to provide electricity in the districts mentioned.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Electrical Distribution of Yorkshire, Ltd., to supply electricity in the urban district of Cudworth and the parish of Billingley; Bridport Town Council to supply in the borough and certain parishes in the rural districts of Bridport and Beaminster; the Power Development Co., Ltd., to supply in the borough of Romsey, the rural districts of Romsey and New Forest, and part of the rural district of Lymington; and Knaresborough Urban District Council in certain parishes in the rural district of Knaresborough.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Derbyshire and Nottinghamshire Electric Power Co. to supply electricity in the urban districts of Bakewell, Baslow and Bubnell, and South Darley, and part of the rural district of Bakewell.

Thornton.—Loans.—The Urban District Council is applying for sanction to borrow £10,000 for mains and services, £2,000 for meters, and £600 for overhead cables to Little Thornton.

Tramway and Railway Notes.

Bradford.—Year's Working.—We have received from Mr. R. H. Wilkinson, general manager of the Corporation tramway undertaking, a copy of his report, together with the statement of accounts, for the year ended March 31st last. The revenue amounted to £621,963, as against £628,263 in the preceding year. Working expenses were £491,042, as against £486,893, leaving a gross profit of £130,921 (£141,371), to which was added a balance from the Parcels Department of £1,520 and revenue from other sources, making a total of £136,143. After deducting capital charges and a deficit of £5,845 on the railless-car system, there was a net surplus of £23,799, of which £9,200 was contributed towards the relief of the rates and the remainder transferred to reserve and renewals fund. The result of the previous year's working was a profit of £47,133. The capital expenditure during the year amounted to £44,875, renewal of permanent way being responsible for the bulk of this amount. The number of passengers carried increased from 100,150,739 (railless cars, 3,836,123) to 101,312,107 (railless cars, 4,050,469), and the car-miles run from 7,045,762 (railless cars, 425,876) to 7,082,569 (railless cars, 458,888). Tramway track totalling 3¼ miles was renewed during the year, and work commenced on the erection of equipment in connection with the railless-car service to Clayton.

Chile.—Proposed Underground Railway.—A proposal is under consideration to construct two lines of underground electric railways in the city of Santiago, at an estimated cost of between 60 and 70 million pesos. It is suggested that a station should be provided every 400 yards.

Continental.—Hungary.—The Hungarian Government has received from an English syndicate an offer which would provide a solution of the financial problem of the electrification of the State railways. Should an agreement with the syndicate be concluded, a beginning would be made with the electrification of the Budapest-Herceghalom line and the construction of works at Varpalota, the scheme being commenced early next year. The next section to be dealt with would be the Budapest-Hatvan line.—*Reuter* (Budapest).

Switzerland.—Work on the electrification of the railway between Basle, Brugg, Baden, and Zurich is nearing completion, and it is expected that the electric trains will be running by November next. As a result of the electrification, the time for the express trains between Basle and Zurich will be reduced by 18 minutes and that of ordinary trains by 29 minutes.

Exeter.—Tramway Extension.—At a recent meeting of the City Council, the Town Clerk was instructed to take the necessary steps to obtain powers for extending the tramway system to the city boundary at Whipton. It was further decided that when the widening of Fore Street, Heavitree, was undertaken, the tram track from Homefield Place to Church Street should be doubled, at an estimated cost of £1,620.

London.—New Tube Connection.—Work is proceeding on the construction of a new underground railway tunnel which will be nearly 1,000 ft. long and situated at King's Cross. It will eventually connect the Piccadilly and City line tubes, and will enable the rolling stock of the latter line to pass through to the general overhaul depôt at Acton works, and there be overhauled more conveniently than at Golder's Green, where this work is now done. The greater part of the new tunnel has now been excavated, and the work will be completed within a few weeks. The line will not be used for passenger traffic.

L.C.C. Tramway Extension.—According to *The Times*, the L.C.C. tramway extension between Beckenham Lane, Southend Village, and Downham was opened for traffic on September 28th, service 54 affording direct journeys to and from Victoria. The new tramway is a mile long, and a further extension to Grove Park Station is in progress. There will be a 2½-minutes' service in each direction during the "rush" hours, and a 3-minutes' service at other times.

Maidstone.—Railless Cars.—The Town Council is recommended by the Transport Committee to apply to the Ministry of Transport for an Order authorising it to run railless cars over the routes in the borough at present served by the light railway system, and for sanction to a loan of £21,200 to carry out the scheme.

Telegraph and Telephone Notes.

France.—New Radio-Telegraph Apparatus.—The French postal authorities are conducting tests at the Croix d'Hins wireless station, near Bordeaux, of telegraph apparatus which, it is claimed, will, if successful, effect a considerable reduction in rates. The preliminary tests are being made with Antananarivo, Madagascar, and they are described as having so far given excellent results. It would appear that the apparatus is an application of wireless to the existing Baudot system; transmission by the new apparatus is said to be fifteen times faster than is possible by present methods, while none of the present security or secrecy is sacrificed. The messages are automatically transmitted and printed at the receiving end.

The experiments are the result of the investigations of a Strasburg engineer, M. Verdan, who is using ordinary Baudot apparatus, with a special arrangement by which messages may be repeated two or three times to ensure correct reception. The postal administration proposes to use the new mode of transmission for communication between France and the French colonies. The speed of a wireless Baudot is slightly less than that of a telegraph Baudot, but is more rapid than wireless transmission by the old method; moreover, interruptions due to atmospheric and other disturbances are eliminated. The first experiments with M. Verdan's apparatus were carried out between Nice and Corsica, and the post office engineer at Nice has been sent to Madagascar and is conducting the experiments from that end. M. Verdan has just been awarded the Legion of Honour for his "services in the cause of progress."—*Reuter* (Paris).

Telephone Service.—The rumour recently current that the French telephone system was to be acquired by a foreign firm has been denied by the Ministry of Posts and Telegraphs. The Ministry says that the news that the Government has been studying foreign automatic systems is responsible for the rumour.

Germany.—Long-Distance Telephony.—Two direct telephone lines between Berlin and Paris have just been inaugurated. Instead of the cable passing *via* Strasburg, it is linked up *via* Frankfort, which reduces the distance by about 125 miles. The two new circuits have cost more than 20 million francs, but it is considered that the expenditure was well worth while, as urgent calls can be obtained within a minute.—*Reuter* (Paris).

Italy.—New Telephone Cable.—A scheme for connecting Naples with Rome and Milan by an underground interprovincial telephone cable has been approved by the Government. The cost is estimated at 500 million lire, and the scheme will take five years to complete.

Morocco.—New Telegraph Apparatus.—New apparatus, devised by G. M. Carrat, Inspector of Telegraphs, of Paris, has recently been installed in connection with the telegraph cable between Brest (France) and Casablanca (Morocco), a distance of 1,600 miles, by means of which it is stated that the efficiency of the line has been increased 80 per cent.

Postal Officials.—Congress in Paris.—The International Congress of Postal, Telegraph, and Telephone Workers, which opened at Paris, France, on September 20th, was attended by 69 delegates, representing fifteen countries and half a million employés. Since the last congress was held Ireland, Australia, Austria, and Esthonia have become affiliated, while the United States and Canada were represented for the first time. The sittings were presided over by Mr. J. W. Bowen, general secretary of the British Union of Post Office Workers and president of the Postal International. It is reported that the Congress has decided to refuse to admit the Russian Syndicate of Postmen.

The Azores.—New Radio Stations.—Various new wireless stations are being erected in Madeira and the Azores. Hitherto these islands have maintained communication with the mainland and with each other by submarine cable and inadequate wireless. On some occasions both these means have broken down, and some of the islands have been completely isolated until repairs could be carried out.—*Reuter* (Lisbon).

Radio Notes.

Czecho-Slovakia.—New Bohemian Station.—A new broadcasting station is being constructed at Satalice, near Prague, to be reserved exclusively for the emission of speeches, lectures, agricultural reports, &c.; it will have a power of 5 kilowatts and will be managed by an experienced staff from the Kbely station, which will now be exclusively reserved for military use. The equipment used at the Satalice station will be that at present in service at the Podebrady station.—*Reuter's Trade Service* (Prague).

Germany.—Political Supervision.—The Minister of the Interior, taking advantage of a safeguarding clause in the contract permitting the wireless stations of the German Post Office to be used for broadcasting, has set up what amounts to a political censorship, says *The Times*. He has appointed an official of his Ministry and two members of the Prussian Diet to act as a "Political Committee of Supervision," whose duty it will be to keep an eye on all political items in the broadcasting programmes, both news and lectures. Moreover, the final decision in all political questions which may arise in the preparation of programmes will rest with the Committee.

South Africa.—Finance.—The demise of radio-broadcasting in the Union has lately been prophesied in some quarters. According to *World Radio*, the expenditure of the Johannesburg station, which is operated by a private company, amounted last year to £17,139 (the orchestra absorbing £7,596) and the revenue was £12,973, so that there was a loss of £4,166. The number of licences dropped from 8,281 to 5,268. Durban's position is worse; there the station is run by the municipality, and the deficit for the current year is estimated at no less than £7,600. Hitherto, this state of affairs has been attributed to the "pirates," and there has been an outcry for their prosecution under the new Radio Act. The fees now range from 35s. to 7s. 6d., according to distance from the station, and it is hoped that this reduction will bring in a large number of subscribers; since July 1st 2,600 new licences have been issued.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—Melbourne.—October 20th. Victorian Government Railways. Rail motor equipment. (A.X. 3449.)*

October 26th. Postmaster-General's Department. Telephone plugs and sleeves. (B.X. 2799.)*

November 9th. Telephone transformers. (B.X. 2797.)* Telephone protective apparatus. (B.X. 2840.)*

November 26th. Primary battery material. (B.X. 2900.)*

Sydney.—October 18th. Municipal Council. Two 100-ton electrical overhead travelling cranes. (A.X. 3467.)*

November 1st. Boiler feed pumps for Bunnerong power station. (A.X. 3470.)*

November 15th. 33,000-V cable and pilot cable. (Spec. 1,047.) (B.X. 2882.)*

November 29th. Circulating water screens. (Specification 1,014.) Specifications from Constructional Engineer, Electricity Department, Town Hall, Sydney.

Barnes.—October 12th. Electricity Department. One 40,000-lb. water-tube boiler, coal- and ash-handling plant, steel-plate chimney, bunkers, &c. (September 24th.)

Barry.—October 25th. Gas, Water, and Electricity Department. Underground mains, sub-station transformers, and meters. (September 24th.)

Carlisle. — October 18th. Electricity Department. Lagging of the complete steampipe system at the new generating station. (See this issue.)

Dublin.—October 18th. Electricity Supply Department. Four water-tube boilers, stokers, economisers, feed pumps and accessories, necessary buildings, foundations, &c. (September 10th.)

5,000-kW generating set complete. (September 17th.)

Durham.—October 16th. Durham County Council. Electrical work required in conversion of Earl's House School and other buildings into tuberculosis hospital. Particulars from Messrs. W. & T. R. Milburn, architects, 19, Fawcett Street, Sunderland.

Edinburgh.—October 18th. Electricity Supply Department. Two motor-driven circulating water pumps, drainage pump, valves and pipework. (September 17th.)

Egypt.—Cairo.—January 1st. Director-General, Mechanical Department, P.W.M. Supply and erection at the site of the Seru pumping and power station of four internal-combustion Diesel alternator groups, three pumps and accessories. Chief Inspecting Engineer in London, Queen Anne's Chambers, Broadway, Westminster, S.W.1. Supply of telegraph and telephone materials, at a cost of between £E.26,000 and £E.28,000.

October 11th. Public Works Department. One d.c. generator and one internal-combustion engine for Helwan-les-Baino electric power station. (B.X. 2883.)*

November 1st. Director-General of Municipalities and Local Commissions, Savoy House, Cairo. Supply of about 30,000 electric lamps to the various municipalities and local commissions.—*Reuter's Trade Service* (Cairo).

Eston.—October 8th. Urban District Council. Electrical stores, &c., for five months. Forms and specifications from the Clerk to the Council, Mr. Thomas Belk, Council Offices, Cleveland House, Grangetown.

Hull.—October 5th. Electricity Department. One 20-ton electrical overhead travelling crane. (September 17th.)

India.—October 16th. India Store Department. Four electrically-driven horizontal centrifugal or turbine pumping sets, with transformers. (A.X. 3590.)*

October 20th. Sub-station plant for Ridge Institute, Jubbulpore, including transformers, condensers, cables, ironclad switchgear, &c. (See this issue.)

London.—London County Council.—October 11th. Electrical installation at the County Secondary School, Sutherland Grove, Wandsworth, S.W. (See this issue.)

Liverpool.—October 5th. City Engineering Department. Two complete sets of pneumatic crude sewage ejectors and electrically-driven air compressors. Forms of tender from the City Engineer, Municipal Buildings, Dale Street, Liverpool.

Manchester.—October 8th. Electricity Department. Two 25,000-kVA and one 1,250-kVA, 3-phase transformers and one 100-ton electrically-operated crane. (September 10th.)

October 12th. Tramways Committee. Permanent way special track work. Specifications and forms of tender from Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly.

October 11th. Board of Guardians. Twelve months' supply of electric lamps. Forms of tender from the Union Offices, All Saints', Manchester.

New Zealand.—Christchurch.—October 19th. Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*

Wellington.—November 2nd. Public Works Department. Electric generators and turbines. (B.X. 2622.) Indoor control gear and switchgear. (B.X. 2675.) 110,000-V transformer for Waikaremoana power scheme. (B.X. 2744.)*

November 23rd. Lightning arresters and transformers. (B.X. 2792.)*

November 30th. 110-kV transformers. (B.X. 2874.)*

January 4th. Switchgear and transformers for the Waikaremoana electric power scheme. (B.X. 2872.)*

December 10th. Government Railways. Electric motors. (B.X. 2861.)*

November 8th. Post and Telegraph Department. Diaphragms, cords, &c. (B.X. 2860.)*

New Plymouth.—October 16th. Harbour Board. One 30-cwt. portal electric jib crane, &c. (A.X. 3458.)*

Auckland.—October 11th. Electric Power Board. Ironclad switchgear and single-phase transformers. (B.X. 2793.)*

Invercargill.—December 1st. Southland Electric Power Board. One 3,200-h.p. horizontal Francis turbine and one 2,350-kW generator. (B.X. 2822.)*

Pickering.—The Pickering and District Co-operative Society, Ltd., is inviting tenders for the installation of an electric generating plant and wiring for approximately 60 lights.

Pudsey.—October 5th. Electricity Department. L.p. cables (approx. 4 miles), joint boxes, feeder pillars, &c. (September 17th.)

Sheffield.—October 14th. Electricity Supply Department. One 10,000/12,500-kW turbo-alternator. (See this issue.)

South Africa.—PRETORIA.—October 7th. Municipal Council. Transformer and switchgear for the abattoir sub-station. (B.X. 2851.)*

CAPE TOWN.—October 20th. Electricity Department. Motors and starting switchgear for Brackenfel Quarry. (B.X. 2902.)*

Thame.—October 11th. Board of Guardians. Installation of electric lighting at the Institution. (See this issue.)

Ticehurst.—October 6th. Board of Guardians. Electric lighting installation, Flimwell Institution. Mr. W. Bennett, clerk, Wadhurst.

Watford.—October 4th. Town Council. Wiring small houses under the rental wiring scheme. Mr. A. W. Barham, borough electrical engineer.

Wolstanton (Staffs.). — October 23rd. Staffordshire County Education Committee. Electric wiring of Wolstanton Boys' New Secondary School. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Bexhill.—Electricity Committee. Accepted:—
Cable.—British Insulated Cables, Ltd. (£803); Enfield Cable Works, Ltd. (£91).
600 meters.—Electrical Apparatus Co., Ltd.

Coventry.—Electricity Committee. Accepted:—
Generating plant for the new power station at Longford:—
Two 18,750-kW turbo-alternators; eight 60,000-lb. boilers (£510,848).—British Thomson-Houston Co., Ltd.

Croydon.—Electricity Committee. Accepted:—
Electric coal-handling crane.

S. Butler & Co. (Accepted.)	**£1,244**
Taylor & Hubbard, Ltd.	1,286
Bedford Engineering Co.	1,475
T. Smith & Son (Rodley), Ltd	1,565
T. Broadbent & Sons, Ltd.	1,625
Babcock & Wilcox, Ltd.	1,855
Stothert & Pitt Ltd.	1,862
J. M Henderson & Co.	1,875
Sir W Arrol & Co, Ltd.	1,890
Butters Bros. & Co.	1,985
J. Carrick & Sons, Ltd.	2,070

Electric crane track:

R. H. Neal & Co., Ltd. (Austin Construction Co.) (Accepted.)	**£350**
J. Booth & Bros., Ltd.	475
Bedford Eng. Co.	480
R. W. Blackwell & Co., Ltd.	620

East Preston.—Board of Guardians. Accepted:—
Conversion of water pumping from steam to electricity (£280).—Duke and Ockenden.

Glasgow.—Corporation.
Electric lighting, bells, and fire alarms at Mearnskirk Sanatorium (£1,880).—Kennedy, Stark & Co.
Main supply cables (£2,440).—James Brash & Co.

The Scottish Board of Health has approved the acceptance by the Corporation of Messrs. James Laird & Co.'s offer, at £963, for the electric lighting work at the pavilion, Bellefield Sanatorium.

Tramways Committee. Accepted:—
Lead-covered cable.—Standard Telephones & Cables, Ltd.
D.c.c. wire.—R. Johnson & Nephew, Ltd.; and Siemens Bros. & Co., Ltd.
Gear cases.—W. C. Yuille & Co., Ltd.
Insulated bolts.—Birkbys, Ltd.; and British Insulated Cables, Ltd.

Grimsby.—Highways Committee. Recommended:—
Installation of electrically-operated gates at bridge (£1,361).—Sir William Arrol & Sons.

Electricity Committee. Recommended:—
Cable.—Greenwich Cable & Wire Co. (£949); Johnson & Phillips, Ltd. (£1,769).
Fibre ducts (£813).—Key Engineering Co., Ltd.
Feeder cables (£1,163).—Johnson & Phillips, Ltd.
Cable work at pumping station (£118).—A. H. Webster & Co., Ltd.

Guildford.—Electricity Committee. Accepted:—
Repairs to battery (£461).—D.P. Battery Co., Ltd.
Cable (£637).—Standard Telephones & Cables, Ltd.
New generating equipment:—

C. A. Parsons & Co., Ltd.,	with Stirling boilers. (Accepted)	**£130,874**
Do.	with Thompson boilers ...	131,590
Do.	with Babcock boilers ...	134,000
Brush Electrical Engineering Co., Ltd.,	with Stirling boilers	132,200
	with Thompson boilers	132,200
	with Babcock boilers	134,140

India.—Bombay, Baroda, and Central Railway. Accepted:—
17,400 plates for train-lighting accumulators.—Fuller's United Electric Works, Ltd.

Irish Free State.—DUBLIN.—The undermentioned contracts were placed by the Controller of Stores (Posts and Telegraphs) from July 23rd to August 28th:—
Telephone bells.—Sterling Telephone & Electric Co., Ltd.
Telephone bell sets.—Siemens Bros. & Co., Ltd.
Cable.—Stramberg Carlson Telephone Mfg. Co.; F. Routledge; and V. Zorn.
Cases for switchboards.—T. R. Scott & Co.
Bridging coils.—Telephone Mfg. Co., Ltd.
Generators.—Sterling Telephone & Electric Co., Ltd.
Telephone indicators.—Ericsson Telephones, Ltd.
Telephone relays.—International Electric Co., Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.
Wire.—Des Cableries et Trefileries; Goerz Bros.; and Kellie (Ireland), Ltd.

Lanarkshire.—County Council. Accepted:—
Installing electric light at Roadmeetings Hospital, Carluke (£1,381).—Johnston, Park & Co., Glasgow.

London.—ADMIRALTY.—Accepted:—
Admiralty-pattern switches.—Edison Swan Electric Co., Ltd.

POPLAR.—Electricity Committee. Accepted:—
Portable coal conveyor (£200).—C. H. Johnson & Sons.

ST. MARYLEBONE.—Electricity Committee.
Wiring for electricity tenements in Ashland House (Ashland Place) and Berkeley Buildings:—
The Committee recommends that the resolution of June 17th (see ELECTRICAL REVIEW, June 18th, p. 919), accepting the tender of the London and South Wales Electrical Engineers, Ltd., be not proceeded with, and that the tenders of Ridout & Ratcliff, Ltd., for wiring Ashland House, and H. J. Cash & Co., Ltd., for wiring Berkeley Buildings, be accepted.

Stoke-on-Trent.—City Council. Accepted:—
Plant extensions at the Central power house:—
10,000-kW turbo-alternator, condensing plant and auxiliaries (£41,905).—Metropolitan-Vickers Electrical Co., Ltd.
Natural-draught cooling tower (£6,597).—Davenport Engineering Co., Ltd.
Ironclad l.p. switchgear (£2,571).—A. Reyrolle & Co., Ltd.

Tynemouth.—Electricity Committee. Accepted:—
Cables (£1,900).—Hackbridge Cable Co., Ltd.

Forthcoming Events.

Electrical Power Engineers' Association (Southern Division).—Friday, October 1st. At the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, W.C. At 7 p.m. Lecture on "Some Principles of Electric Illumination," by Mr. W. J. Jones.
Saturday, October 2nd. At the Hotel Cecil, Strand, W.C. At 5.30 p.m. for 6 p.m. Annual dinner.

Faraday Society.—Friday, October 1st. At Burlington House, Piccadilly, W. From 2.30 to 4.30 p.m. and from 5 to 6.30 p.m. General discussion on "Physical Phenomena at Interfaces, with Special Reference to Molecular Orientation."

Junior Institution of Engineers.—Friday, October 1st. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Notes on Transformer Testing and Test Plant Requirements," by Mr. L. Smith.
Friday, October 8th. At 7.30 p.m. Paper on "A Survey of Modern Airless Injection Oil Engines," by Mr. N. J. Griffin.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, October 2nd. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m. Address by the Chairman, Mr. D. Thomas.

Society of Engineers.—Monday, October 4th. At Burlington House, W. At 5 p.m. Paper on "The History of Artificial Lighting," by Mr. W. J. Liberty.

Institute of Transport.—Monday, October 4th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Presidential address by Mr. R. H. Selbie.

Birmingham Wireless Exhibition.—Tuesday, October 5th. At the Drill Hall, Thorp Street.

Electrical Society of Glasgow.—Tuesday, October 5th. At 30, Gordon Street, Glasgow. At 7.30 p.m. Paper on "Cable Ailments: Constitutional and Otherwise," by Mr. A. F. Stevenson.

National Association of Supervising Electricians.—Tuesday, October 5th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. Presidential address by Mr. A. M. Sillar.

Institution of Heating and Ventilating Engineers.—Tuesday, October 5th. At Caxton Hall, Westminster, S.W. At 7 p.m. Paper on "Panel Heating," by Mr. A. H. Barker.

Salford Technical and Engineering Association.—Saturday, October 9th. At the Royal Technical College. At 7 p.m. Paper on "Wireless Components and their Functions," by Mr. A. Hall.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—
CENTURY electric irons.
I.T.E. circuit breakers.

Notes.

Summer Time Ends.—Readers are reminded that summer time ceases at 3 a.m. on Sunday next, October 3rd, when all clocks should be put back one hour.
The Government has stated that it is impossible to extend the period of summer time without special legislation.

Model Engineering Exhibition.—The "Model Engineer" Exhibition was held at the Royal Horticultural Hall, Westminster, from September 17th to 25th, and attracted a large number of visitors. There was an excellent display of models, besides tools and components, electric motors, wireless apparatus, &c. Major Raymond Phillips showed an electric locomotive controlled by sound waves. For the model-making competition organised by the proprietors of the *Model Engineer* there were 134 entries.

Liverpool Electro-Harmonic Society.—This Society opens its third season on the fourth Friday in October with a concert at the Bear's Paw Restaurant. Good artistes have been engaged, but more members are wanted so that this season may be even more successful than those that have preceded it. The membership is now 100. It is specially desired that the electrical contractors' side shall be more fully represented and the Committee specially invites applications from such. Membership forms can be obtained from the hon. secretary, Mr. E. Y. Wilkinson, 16, South Castle Street, Liverpool.

The Electricity (Supply) Bill.—In the House of Commons, on Monday last, Mr. D. Herbert (Watford) asked the Prime Minister whether his attention had been called to a letter recently written by the Electricity Commissioners to electricity undertakings informing them that they had appointed an individual to assist in the performance of certain work under a clause of the Electricity Bill in anticipation of the passing of that measure, and whether he would prevent Government Departments from acting upon the assumption that Bills introduced by the Executive Government would be passed by Parliament with or without alteration.

Colonel Ashley, Minister of Transport, replied that the action taken by the Electricity Commissioners in this matter was taken with his approval. In the case of a Bill before Parliament it was not unusual for Government Departments to take preliminary steps to facilitate the administration of the Act when passed.

Mr. Herbert asked when he would be allowed to raise the matter as a question of privilege, and that it might be submitted to the Committee of Privileges as to whether the wording of the letter was not in the nature of an insult to Parliament; the Speaker said he did not see that any question of privilege arose, but would be prepared to consider any point submitted to him.

Meter Engineers' Technical Association.—The second general meeting of the Association was held at the E.L.M.A. Lighting Service Bureau on Thursday last week, when the President, Mr. G. F. Shotter, delivered his presidential address. In the discussion which followed it was agreed that the President had succeeded in giving a comprehensive survey of the field of metering; and that he had provided ample material to stimulate the active interest of members and others.

Appointments Vacant.—Assistant electrical engineer (Rs. 375+) for the Indian State Railways. Superintendent of telegraphs (wireless) and telephones (£500+), telephone linesman (£200) for the Government of the Falkland Islands. Junior technical officer (approx. £235) for the Royal Aircraft Establishment, South Farnborough; three junior switchboard attendants (£195), one junior sub-station attendant (£165), plumber-jointer, for the Fulham Corporation Electricity Department; first grade instructors (£400), for the Cape Town Technical College. (See our advertisement pages to-day.)

Electrical Films Display.—On Tuesday last, by arrangement with the British Electrical Development Association, Dr. A. Ekstroem, of Sweden, showed to a number of electrical engineers and others interested in electrical development, at Messrs. Gaumont's Trade Theatre, London, two films bearing on rural electrification in Sweden. One film depicted the time saving to the cook or housewife working in an electric kitchen over the time taken for similar work in a kitchen equipped for cooking by wood or coal fuel. The electric kitchen was provided with a thermal hot-water storage apparatus and a heat-storage cooker (Electrical Review, September 17th, 1926, pp. 445 and 473). In each case the operations for a whole day's cooking for the average Swedish farm were shown, and the relative times saved and expended in the cooking of each item of food, each meal, and for the whole day, were diagrammatically represented, showing, of course, a great advantage for the electric kitchen. The second film was one of a series which Dr. Ekstroem intends to show at the Institution of Electrical Engineers in November in connection with a paper on "Electro Farming." It showed produce being brought from the fields to the farm buildings and unloaded and taken to the threshing floor by means of electrically-driven winches, grabs and runways. Mr. R. Borlase Matthews introduced Dr. Ekstroem as the leading authority on rural electrification in Sweden. In a few preliminary remarks, Dr. Ekstroem said that in Sweden electricity was of more importance in the country than in the city. Sweden had been compelled to make use of her water power, due to lack of coal and oil, and, during the years of development, had experienced certain drawbacks. The technical experts had not been sufficiently interested in the commercial side of the industry, and there was a lack of experienced electrical contractors in the country. In spite of these drawbacks, any Swedish farmer maintained that the most important development in that country in his time was the electrification of his farm. In Sweden they had more than proved that there was good business in rural electrification.

Electrical Trades Benevolent Institution.—On August 27th we announced that the annual festival dinner of the Institution would be held on November 17th; owing to unavoidable circumstances it has been found necessary to alter the date, and the festival will be held at the Trocadero Restaurant on Wednesday, November 10th, instead.

The Information Bureau.—This much-abused term is of late years taking on a new significance. To-day, in its true form, the information bureau is an invaluable handmaid to the engineer, whatever be the particular branch of the industry in which he has specialised. The information bureau has been recognised for some time by the formation of an Association in the United States of America; also, here, an organisation—the Association of Special Libraries and Information Bureaux—last week held its third conference at Balliol College, Oxford. A correspondent writes:—

While the majority of the members are associated with Government departments and the big commercial industries of this country, engineers were well represented, both personally and by members of their staffs.

In this country at present there are nearly 500 special libraries of a scientific nature, *i.e.*, collections of books, pamphlets and data relating to the specific interests of research organisations, commercial and engineering firms, and the like. A volume is in the Press giving particulars of these special libraries and the terms upon which they can be consulted. A number of them are now being utilised as the tools of even more important departments which are known as Information Bureaux. While the work of the Association is at present chiefly concerned with the library side, more and more interest is being taken in information bureaux.

Such a conference is a revelation as to the large amount of work that is being accomplished in a quiet way—work that takes note of everything published that is at all likely to serve the interests of the organisation concerned; and there are over 24,000 periodical scientific publications issued per annum.

It is not generally known that most of the big electrical firms have their own special libraries and information bureaux; hence these proceedings are of more interest to electrical readers than would at first appear. Every engineer has accumulated a collection of data—and nearly every engineer has evolved a system of filing it, though, alas! the system only too often breaks down with the efflux of time. A conference of this nature is the best means of finding out how best to file so as to find again. However, there is still a fierce controversy between advocates of dictionary and classification systems; there are strong points in favour of the latter, with preference for the Dewey system coupled with the Brussels modifications. A thing that such a conference discloses is what a lot of duplication of work there is in abstracting. Hence many suggestions are made as to how best to avoid overlapping. Incidentally, the sources of many abstracts are rendered available.

In connection with his paper on new indexing devices, Mr. H. Rottenburg demonstrated an electrically-operated gumming machine. It seems a far cry from the office boy with his pastepot and brush, to this modern refinement. However, it does what the said junior rarely attains, *viz.*, quick and even application of the adhesive, spread so thinly that it dries quickly and there is no surplus to come outside the limits of the paper being gummed. The only other directly electrical reference at the conference was to the use of ultra-violet light for photographic reproduction through a prism directly on to bromide paper. The use of cover glass, transparent to ultra-violet light, was suggested, and also the employment of a yellow screen in front of the lens, when copying documents with blue and yellow on them, with which some operators had had trouble.

Mr. R. Borlase Matthews, Wh.Ex., M.I.E.E., read a paper on information bureaux, and the compilation of data for forecasting the course of business, &c. Mr. W. C. B. Sayers dealt with "Systems of Classification."

Power Plant in Mines.—In the House of Commons on September 28th, Sir Philip Dawson asked the Secretary for Mines what coal mines in England and Scotland had electric power plant installed; its total capacity; the consumption of electricity for their own purposes by mines; the total h.p. of mechanical plant installed above and below ground; the number of pit ponies employed; the number of compressed-air, internal-combustion and electric locomotives in use underground; the number of electric coal cutters and pneumatic picks employed; and the number of mines which did not use electric power above and under ground.

Col. Lane Fox referred the hon. member to Table 43 of the Statistical Appendix to the Annual Report of the Mines Department for 1924, stating that the report for 1925 had not yet been published. Further information, he said, would be available when the results of the 1924 Census of Production were published.

The Volta Centenary.—From the last issue of *Voltiana* we learn that subscriptions to the amount of 18,636,450 lire have already been received towards the cost of the Volta centenary celebrations, which are to be held at Como, Italy, next year.

Sugar Factory in the Irish Free States.—The sugar factory at Carlow is now fast approaching completion, and the Irish Sugar Manufacturing Co. expects to commence operations by the end of October. Two 2,450-h.p. turbines are installed in the power house and will be able to supply premises outside the factory with electricity if required.

Halving the Electron.—It is reported that Prof. Ehrenhaft, of Vienna, claims to have observed phenomena which indicate that an electrical charge of half an electron may exist. The statement has been received in scientific circles with considerable doubt.

B.E.S.A. Publication.—The British Engineering Standards Association has issued a revised edition of the B.E.S.A. Publication No. 168, for the electrical performance of industrial electric motors and generators with Class A insulation. This specification was originally published in 1923, and forms part of the series of eight specifications which replace publication No. 72-1917. The revision is mainly that of arrangement, and in order to bring the British specification into the form recommended by the International Electrotechnical Commission, the body of the specification contains only matter defining the performance of the machine on test at rated load. Informa-

tion regarding the service conditions under which the machine is suitable for operation at its rated load, and sustained overloads permissible in service under various conditions of cooling air, are given in a separate appendix. These permissible sustained overloads have been slightly rearranged in a more convenient form, and it is felt that the new edition should make this already serviceable specification yet more useful to both manufacturer and user. Copies may be obtained from the B.E.S.A., Publications Department, 28, Victoria Street, London, S.W.1, price 1s. 2d. post free.

A Tramcar Smash.—A disastrous tramcar smash took place recently at Darwen; a Corporation Hoddlesden car ran down a steep gradient into a billiard hall, which was practically wrecked, and the car itself was reduced to matchwood on the

Tramcar Accident at Darwen.

off-side. One passenger was killed, and the driver, conductor and other people were seriously injured, necessitating their removal to Blackburn Infirmary. This is the first accident on this section since it was opened 25 years ago; it is supposed to have been due to lightning striking the overhead trolley wire during an unprecedented storm, and rendering the electric brake ineffective. On a gradient of one in eight, the hand brake was not sufficiently powerful to hold the double-decked car.

Institution Notes.

Institute of Transport.—The first meeting of the new session will be held at the Institution of Electrical Engineers on Monday next, commencing at 5.30 p.m., when Mr. R. H. Selbie, C.B.E., will deliver his presidential address. The annual general meeting will be held at the same place on November 1st, and the Institute will hold its annual dinner at the Hotel Cecil on November 18th. The dinner of the Yorkshire local section will take place at Leeds to-day, as well as that of the North-Eastern local section at Newcastle-on-Tyne. Amongst the awards made by the Council is the Road (Passenger) Gold Medal (given by the London General Omnibus Co., Ltd.) to Mr. Walter Jackson for his paper on "Electric and Petrol Transport of Passengers in America." The Council has decided that the Institute Silver (Student) Medal shall be awarded annually for the best paper submitted by a student not later than June 30th in each year, dealing with each of the principal forms of transport—economics and operation—alternately. The next Institute examinations will be held on April 28th, 29th, and 30th, 1927.

Institution of Fuel Technology.—AUTUMN PROGRAMME.—The autumn programme of the Institution of Fuel Technology was approved by its Council. The meeting will extend over two days—Tuesday and Wednesday, December 7th and 8th; on the first day Sir Alfred Mond will deliver his presidential address, and an inaugural dinner will be held in the evening. The list of authors and papers includes:—Sir Richard Redmayne, K.C.B., on "The Occurrence, Working and Treatment of Brown Coal, with Special Reference to German Practice"; Mr. S. McEwen on "Low Temperature Distillation of Coal"; and Sir John Biles, K.C.I.E., on "Steam Power Production." Since the general meeting on July 30th last 250 founder members have been enrolled.

Junior Institution of Engineers.—Amongst the awards of the Institution for the past session are: The Institution silver medal to Mr. E. le L. Lamb for his paper, "Electricity in Mining," and the Durham Bursary to Mr. W. A. Sallis for his paper "The Strowger System of Automatic Telephony."

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

The marriage took place at Stafford, on September 20th, of Captain DOUGLAS CHARLES BACON, M.C., consulting electrical engineer, of Manchester, and formerly of the staff of the English Electric Co., Ltd., at Stafford, and Miss M. E. ALDERTON, daughter of Mr. H. L. Alderton, of Tillington, Stanord.

Bexhill Corporation Electricity Committee has further considered the question of the operation of the I.M.E.A. salary scale with regard to the Electrical Engineer. The Committee points out that although the steam generating plant at the main station has been superseded by converting plant taking a supply in bulk, the capacity of the new plant is more than double that of the old machinery, and it is satisfied that the duties and responsibilities of the engineer have in no way been reduced. The Committee has come to the conclusion that there is no ground at the present time to discontinue the application of the I.M.E.A. scale.

Mr. E. R. MORTON has just resigned his appointment as manager of the electrical appliances, radio and publicity departments of the Sun Electrical Co., Ltd., to take up the position of sales manager to Kelvinator, Ltd., manufacturers of automatic electric refrigerators, of 29, Kingsway, W.C.2.

After lengthy discussion, the Exeter Corporation has agreed to advance the salary of the tramway manager and engineer (Mr. W. Y. SMITH-SAVILE) from August 1st last from £450 to £500 per annum; to £525 on April 1st, 1927; and thence by annual increments of £25 to £600.

The following appointments for the session 1926-27 have been made at University College, London:—Faculty of Engineering: Dr. J. A. FLEMING, F.R.S.—special lecturer in electro-communications; Mr. R. R. POOLE, B.Sc.—assistant in electro-communications.

Professor G. F. CHARNOCK has just retired from the position of head of the Department of Engineering at the Bradford Municipal Technical College, an office he has held with distinction for many years. He will continue some consulting and inspecting practice and literary work and lecturing. Prof. Charnock is succeeded by Mr. H. W. SWIFT, chief lecturer in mechanical engineering at Leeds University, and for the past two years hon. secretary of the Yorkshire branch of the Institution of Mechanical Engineers.

Mr. R. G. PARROTT, manager of the Metropolitan-Vickers Electrical Export Co. for the Argentine, Chile, Peru, &c., sailed by s.s. *Almanzora* from Southampton on September 24th, returning to his headquarters at Buenos Aires after a four-months' business and holiday visit to this country and the Continent. Mr. Parrott is chairman of the Argentine local section of the I.E.E. for this year, and is also acting on the Electrical Trade Committee of the British Chamber of Commerce in the Argentine.

Mr. H. HAIGH, deputy electrical engineer at Morecambe, was last week appointed electrical engineer-manager to the Gainsborough Urban Council.

Mr. G. P. SHALLCROSS, borough electrical engineer of Birkenhead, who recently retired on superannuation, has been presented by Corporation officials with a gold watch.

Mr. W. GODFREY, for 26 years a member of the staff at the Tunbridge Wells electricity works, is retiring, and on September 23rd he was presented by the borough electrical engineer, Mr. R. N. Torpy, on behalf of the staff, with an illuminated address.

The Sunderland Corporation Tramways Committee has appointed Mr. H. W. SNOWBALL, manager of the Moor Engineering and Pipe Works, Ltd., Sunderland, as rolling stock superintendent in succession to Mr. George Haswell, who has retired.

The marriage took place on September 15th at Whitworth, near Rochdale, of Mr. FRANK B. HOLT, A.M.I.E.E., of Ashton-under-Lyne, and Miss MARJORIE R. KERSHAW, daughter of Councillor G. Kershaw, of Broadley, near Rochdale.

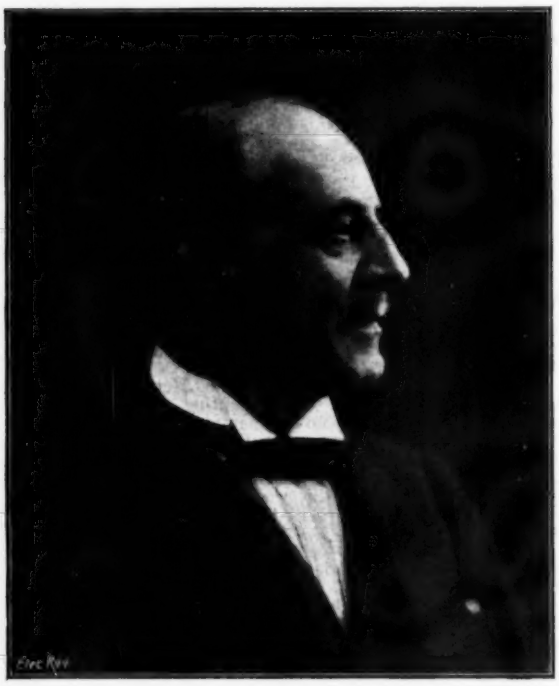
At Sydney, in August, a luncheon was given in honour of Mr. G. B. CLERK, managing director of the English Electric Co. (Australia), Ltd., who was leaving for England on business connected with his company. The event was arranged by the Metal Trades Employers' Association.

Mr. H. ST. J. SOMERSET, general superintendent of the Broken Hill Associated Smelters Pty., Ltd., at Port Pirie, has been appointed general manager of the Electrolytic Zinc Co. of Australia, following the appointment of Mr. H. W. GEPP to be chairman of the Migration and Development Commission. Mr. Somerset will have his headquarters at Melbourne.

Mr. T. H. HUNTER (for many years branch manager of the B.T.-H. Co.) has now taken over the branch managership of the Stearn Electric Co., Ltd., Birmingham.

Mr. T. P. WILMSHURST, for 28 years borough electrical engineer at Derby, has resigned, having accepted an appointment under the Government, which he will take up on November 1st. The *Midland Daily Telegraph* quotes a tribute to Mr. Wilmshurst by Ald. W. G. Wilkins, of the Derby Corporation Electricity Committee, in the course of which Mr. Wilkins says:—"Derby's loss is England's gain. In parting with him we believe that the same far-seeing and understanding brain which has built up Derby's electrical undertaking will be used to develop the great scheme of national electricity to which this country is committed. A wiser choice could not have been made by the Government."

Accompanying these notes we publish a photograph of Mr. James W. McKay, who was recently appointed general secretary of the Electrical Wholesalers' Federation, Ltd. (19-21, Hatton Garden, E.C.1). The operations of the E.W.F. have been made known to our readers periodically from its inception, and it has had its part to play in the discussions that have taken place during the present year with reference to the relations of the different sections of the industry. It recently reached a stage when the appointment of a whole-time secretary became necessary, a development which suggests increasing activity in safeguarding the interests of wholesalers and establishing or continuing harmonious relations between them and kindred organisations. Mr. McKay, who is a Scotsman, a University man and a practical engineer, was at one time resident engineer representative in South Wales and West of England for the Brush Electrical Engineering Co., Ltd., and the British Electric Traction Co. His early work included colliery electrification and the introduction here of the flame arc lamp. His knowledge of publicity work finds its explanation in the fact that for over nine years he was advertising manager at the Manchester end for the *Daily News*. Other work which renders him a man of affairs includes duties performed at the German Embassy here as British Trade Adviser, and as general secretary of the United Kingdom Business Men's Federation. He has had experience



Mr. James W. McKay,
Secretary of the Electrical Wholesalers' Federation.

in fighting the battles of the small trader against rings and combines; has been and is at present identified with various public movements; and has had experience of Parliamentary work.

Mr. A. W. B. Wilson has resigned his position with the Fuller United Electric Works, Ltd., of Chadwell Heath, where for many years he was the London sales manager, to take up an appointment as sales manager to the London Battery and Cable Co., Ltd., of Hesketh Road, Forest Gate, E.7, as from to-day.

Obituary.—Sig. F. Piola.—The death is reported from Bologna, of Signor Francesco Piola, a professor of the Bologna School of Engineering and vice-president of the Bologna section of the Associazione Electrotecnica Italiana.

Mr. H. Dawson.—The death occurred recently, at the age of 51 years, of Mr. Harry Dawson, who had been for 25 years on the office staff of the Bradford Corporation Electricity Department.

Mr. A. L. Holmes.—The death has taken place of Mr. Arthur Lloyd Holmes, a director and secretary of the Keighley Electrical Engineering Co. Mr. Holmes, who was 50 years of age, underwent two serious operations in Leeds Infirmary, and blood transfusion was tried without avail. He had been connected with the above company for thirty years.

Mr. J. C. White.—We regret to learn that Mr. J. C. White, A.M.I.E.E., of 49, Bridge Street, Manchester, inventor and manufacturer of the J.C.W. wiring system, passed away on Sunday last, pneumonia being the cause. He was at his office on the previous Monday.

Will.—The late Mr. C. S. Gilman, a director of the Westminster Electric Supply Corporation, Ltd., and of the Central Electric Co., left £98,268.

New Companies Registered.

Aedon Portable Wireless, Ltd. (216,366).—Private company. Registered September 23rd. Capital £600 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in scientific and electrical apparatus and machinery, galvanic and electric batteries, fixed and portable wireless sets, aerials, wires, valves, loud speakers, microphones, &c. The first directors are:—A. G. Armstrong, 15, Wetherby Mansions, Earl's Court Square, S.W.; F. W. Richards, Challenge Rubber Works, Elstree, Herts. Qualification, one share. Secretary: A. G. Armstrong. Solicitors: Johnson, Weatherall, Sturt & Hardy, 7, King's Bench Walk, Temple, E.C.4. Registered office: 140, Euston Covered Market, Euston Road, N.W.1.

Colston Electrical Co., Ltd. (216,350.).—Private company. Registered September 22nd. Capital £4,000 in £1 shares. Objects: To acquire the business of an electrician and electrical contractor carried on by A. E. Finch at 9, Denmark Street, Bristol. The directors are: W. J. F. Dutson, A.M.I.E.I., Grove Lodge, Parry's Lane, Stoke Bishop, Bristol, engineer; W. Dutson, Cotehurst, Cotham Park, Bristol, gentleman. Qualification, £20. Secretary: V. F. Fox, Dial House, Combe Down, Bath. Solicitors: David Johnstone & Co., 31a, Corn Street, Bristol.

Synchromatic Time Recording Co., Ltd. (216,368).—Private company. Registered September 22nd. Capital £1,000 in £1 shares. Objects: To carry on the business of electrical contractors, electrical, mechanical, wireless and general engineers, manufacturers of and dealers in electric clocks, electric master, secondary and mechanical clocks and other time-recording machines, &c. The permanent directors are: F. H. Bailey, 177, Upper Parliament Street, Liverpool, engineer; J. B. Campbell, 255, Upper Parliament Street, Liverpool, agent; H. B. Thomas, 177, Upper Parliament Street, Liverpool, agent; W. L. Bailey, 30, Camden Road, Holloway, N. Qualification £50. Remuneration as fixed by the company. Secretary: N. S. Macdonald. Solicitor: J. W. Livesey, junr., Coopers Buildings, 12, Church Street, Liverpool. Registered office: Coopers Buildings, 12, Church Street, Liverpool.

Highgate Cable and Engineering Co., Ltd. (216,095).—Private company. Registered September 7th. Capital, £1,000 in £1 shares. Objects: To carry on the business of engineers for the manufacture of electric cable, plant, iron, brass and general metal founders, and merchants, metal workers, machinists, metal refiners, &c. The subscribers (each with one share) are:—D. Evans, Gwalia House, Pencader, South Wales, accountant; H. L. Evans, 88, Harberton Road, N.19, clerk. The first directors are not named. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: C. A. Thompson, 18, Ironmonger Lane, E.C.

Luen Electrical Supplies, Ltd. (216,098).—Private company. Registered September 7th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in all kinds of plant, machinery, electrical equipment and appliances, &c. The subscribers (each with one share) are:—D. Evans, Gwalia House, Pencader, South Wales, accountant; A. F. Chapman, 40, Willoughby Road, Hornsey, N., accountant. The first directors are not named. Qualification, 100 shares. Remuneration as fixed by the company. Solicitor: C. A. Thompson, 18, Ironmonger Lane, E.C.

London Radio Manufacturing Co., Ltd. (216,279).—Private company. Registered September 17th. Capital, £1,000 in £1 shares. Objects: To carry on business as manufacturers' merchants, dealers, factors, and sales agents of radio instruments, fittings, apparatus, accessories, and articles, &c. The directors are:—L. B. Tickle, A.M.I.M.E., 58, Gonville Road, Thornton Heath, engineer; G. G. Watts, 11, Lyncroft Gardens, Ealing, W.13, publicist. Remuneration, £5 each per annum. Secretary: F. W. Piddock, 25, Albert Road, Mitcham. Registered office: 61, Borough Road, S.E.1.

Ernest Jones (Bradford), Ltd. (216,233).—Private company. Registered September 16th. Capital £3,000 in £1 shares. Objects: To carry on the business of electricians, mechanical and electrical engineers, and manufacturers, workers and dealers in electricity, &c. The first directors are:—A. E. Jones, 37, Lydden Terrace, Leeds, electrical engineer; T. Iveson, 17, Sussex Avenue, Hunslet, Leeds, secretary. Remuneration as determined by the Board.

British Di-Electric Co., Ltd. (216,391).—Private company. Registered September 24th. Capital £2,500 in £1 shares. Objects: To acquire the business of electrical engineers and general factors of electrical goods now carried on at 116, Victoria Street, S.W.1, as "The British Di-Electric Co." The subscribers (each with one share) are:—H. Skipwith, St. Mary's Cottage, Oxted, Surrey, engineer; A. C. W. Goring, 58, Elm Grove, S.E.15; engineer H. Skipworth is permanent managing director and chairman. Qualification of directors, five shares. Registered office: 116, Victoria Street, S.W.1.

Telephones and Accessories, Ltd. (216,416).—Private company. Registered September 24th. Capital £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in telephones and telephone, telegraph and wireless appliances and accessories, &c. The subscribers (each with one share) are:—P. F. Rouse, 40-42, King William Street, E.C.4, solicitor; F. Lloyd, 40-42, King William Street, E.C.4, solicitor's clerk. The first directors are to be appointed by the subscribers. Qualification, 50 shares. Remuneration as fixed by the company. Solicitors: Cruesemann & Rouse, 40-42, King William Street, E.C.4.

Official Returns of Electrical Companies.

Allied Electric Manufacturers, Ltd.—First mortgage debenture, dated September 11th, 1926, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: A. H. Spalton, 14, Dalewood Drive, Beauchief.

Flexible Lamps, Ltd. (195,431).—Capital, £5,000 in £1 shares. Return dated September 8th, 1926. 2,750 shares taken up. £1,800 paid on 2,350 shares (being 16s. per share). £500 considered as paid on 500 shares. Mortgages and charges, nil.

J. S. Ramsbottom & Co., Ltd. (195,414).—Capital, £1,000 in £1 shares. Return dated May 27th, 1926. All shares taken up. £500 paid (being 10s. per share). Mortgages and charges, nil.

A. C. Hodson, Ltd. (196,433).—Capital, £3,000 in £1 shares. Return dated December 31st, 1925 (filed April 21st, 1926). 1,250 shares taken up. £1,250 paid. Mortgages and charges, nil.

Acme Electric Wire and Cable Co., Ltd. (196,546).—Capital, £1,400 in 500 6 per cent. preference and 900 ordinary shares of £1 each. Return dated May 11th, 1926. 300 preference and 750 ordinary shares taken up. £800 paid. £250 considered as paid. Mortgages and charges, nil.

Austin Walters & Sons, Ltd. (196,570).—Capital, £3,000 in £1 shares. Return dated May 15th, 1926. 1,002 shares taken up. £2 paid. £1,000 considered as paid. Mortgages and charges, nil.

Grosvenor Engineers, Ltd. (195,814).—Capital, £600 in 575 preference shares of £1 each and 500 ordinary shares of 1s. each. Return dated June 9th, 1926. 500 preference and 500 ordinary shares taken up. £325 paid. Mortgages and charges, nil.

Cook's Wireless Co., Ltd. (195,750).—Capital, £1,000 in £1 shares. Return dated March 30th, 1926. 732 shares taken up. £32 paid. £700 considered as paid. Mortgages and charges, nil.

G. W., Ltd. (195,698).—Capital, £5,000 in £1 shares. Return dated December 31st, 1925 (filed March 29th, 1926). 102 shares taken up. £102 paid. Mortgages and charges, nil.

Electrical and Chemical Ebonite Co., Ltd. (196,618).—Capital £30,000 in 15,000 ordinary "A" and 10,000 ordinary "B" shares of £1 each, and 60,000 deferred "A" and 40,000 deferred "B" shares of 1s. each. Return dated February 1st (filed March 29th), 1926. All shares taken up. £15,000 paid on the ordinary "A" shares. £15,000 considered as paid on the ordinary "B," deferred "A," and deferred "B" shares. Mortgages and charges, £5,000.

H. T. Bourn, Ltd. (196,170).—Capital, £800 in £1 shares. Return dated December 31st, 1925 (filed March 27th, 1926). 680 shares taken up. £680 paid. Mortgages and charges, nil.

Childs' Electrical Stores, Ltd. (196,263).—Capital, £1,000 in £1 shares. Return dated December 31st, 1925 (filed March 26th, 1926). All shares taken up. £2 paid. £998 considered as paid. Mortgages and charges, £503 15s.

Austin Brothers Electrical Co., Ltd. (196,371).—Capital, £1,000 in 700 ordinary and 300 preference shares of £1 each. Return dated June 2nd, 1926. 642 ordinary and 300 preference shares taken up. £642 paid on the ordinary and £300 considered as paid on the preference shares. Mortgages and charges, nil.

Interchangeable Electric Signs, Ltd. (196,331).—Capital, £2,500 in £1 shares. Return dated March 12th (filed September 16th), 1926. All shares taken up. £2,001 paid. £499 considered as paid. Mortgages and charges, £4,380.

City Electrical Appliances, Ltd. (196,323).—Capital, £5,000 in £1 shares. Return dated June 21st, 1926. 2,157 shares taken up. £2,130 15s. paid. £26 5s. in arrears. Mortgages and charges, nil.

Rudolph, Charles & Goff, Ltd. (196,279).—Capital, £1,000 in £1 shares. Return dated March 1st (filed July 13th), 1926. 100 shares taken up. £100 paid. Mortgages and charges, £400.

Clowne Electric Supply Co., Ltd. (194,933).—Capital, £3,000 in £1 shares. Return dated July 1st, 1926. All shares taken up. £1,500 paid (being 10s. on each share). Mortgages and charges, nil.

New Radnor Electric, Ltd. (194,683).—Capital, £650 in £1 shares. Return dated May 4th, 1926. 632 shares taken up. £600 paid. £32 considered as paid. Mortgages and charges, nil.

Phœnix Dynamo Manufacturing Co., Ltd. (195,266).—Capital, £100 in £1 shares. Return dated May 17th, 1926. Two shares taken up. £2 paid. Mortgages and charges, nil.

Atmos Electrical Co., Ltd. (195,257).—Capital, £2,000 in 1,000 ordinary and 1,000 preference shares of £1 each. Return dated January 4th, 1926. 750 ordinary shares taken up. £250 paid. £500 considered as paid. Mortgages and charges, nil.

Bury Lighting and Heating Co., Ltd. (195,137).—Capital, £1,000 in £1 shares. Return dated December 31st, 1925 (filed March 23rd, 1926). All shares taken up. £600 paid (being 12s. on each share). Mortgages and charges, nil.

Kirkby Stephen Electric Light and Power Co., Ltd. (195,165).—Capital, £1,200 in 110 preference shares of £10 each and 100 ordinary shares of £1 each. Return dated March 18th, 1926. All shares taken up. £1,000 paid on 100 preference shares. £200 considered as paid on 100 ordinary and 10 preference shares. Mortgages and charges, nil.

Telegraph Condenser Co., Ltd. (110,048).—Capital, £5,000 in £1 shares. Return dated June 30th, 1925 (filed August 10th, 1926). 2,000 shares taken up. £2,000 considered as paid. Mortgages and charges, nil.

British Arc Welding Co., Ltd. (108,759).—Capital, £50,000 in £10 shares. Return dated August 19th, 1926. 1,474 shares taken up. £12,740 paid. £2,000 considered as paid. Mortgages and charges, nil.

Imperial Tramways Co., Ltd. (58,981). — Capital, £400,000 in 20,000 preference and 20,000 ordinary shares of £10 each. Return dated April 3rd, 1926. All shares taken up. £100,000 paid on 10,000 preference shares. £300,000 considered as paid on the remainder. Mortgages and charges, £300,000.

W. Sisson & Co., Ltd. (82,295).—Capital, £50,000 in 5,000 preference, 38,000 ordinary, and 7,000 deferred shares of £1 each. Return dated August 3rd, 1926. 4,375 preferred, 31,711 ordinary, and 7,000 deferred shares taken up. £28,686 paid on 4,375 preferred and 24,311 ordinary shares. £14,400 considered as paid on the remainder. Mortgages and charges, £3,342 0s. 11d. due to Lloyd's Bank, Ltd. (overdraft limit £15,000).

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

French Companies.

The *Société d'Electro-Métallurgie de Dives* proposes to pay a dividend of 115 fr. per share for 1925-26, as compared with 80 fr. in the previous year.

The *Société Electro-Câble* reports gross profits of 31,102,000 fr. for 1925-26, as compared with 18,848,000 fr. in the previous year, the net profits being 8,923,000 fr. and 4,460,000 fr. respectively. It is intended to pay a dividend at the rate of 50 fr. per ordinary share, as against 40 fr. in 1924-25.

The *Etablissements Industriels de E.C. Grammont et de Alex. Grammont* report net profits of 10,456,000 fr. for 1925-26, as against 5,164,000 fr. in the preceding year. It is proposed to apply 3,000,000 fr. to depreciation, 5,000,000 to writing down the value of securities, and the balance to writing down various order accounts.

German Companies.

The *Rhenish-Westphalian Electricity Works Company* proposes to pay a dividend of 8 per cent. for 1925-26, as in the previous year.

The *Isaria Meter Works Company*, Munich, which is associated with the Brown-Boveri group, reports that the turnover in 1925-26 increased by 26 per cent. The increase occurred mainly in the home business, as the foreign sales further declined owing to the competition of countries with depreciated currencies. Reserve was exercised by the electricity works in the purchase of meters, as the surpluses were mostly used for improvements and increasing the capacity of the works. The sale of motors suffered from the lack of capital on the part of customers, but the radio department was well occupied. The net profits were 19,000 marks, as against 31,000 marks in the previous year, and again no dividend is being paid.

Ferranti, Ltd.—The report for the year ended June 30th last shows a net profit of £59,765, after providing for debenture interest, depreciation, &c. To this is added £33,313 brought forward, making £93,078. The preference dividends are paid and the reserve is increased to £200,000. The directors recommend a dividend of 20 per cent., free of tax, on the ordinary shares, leaving £36,558 to be carried forward. The meeting was to be held yesterday (Thursday).

Considerable expenditure on buildings and plant has been incurred during the year to increase the productive capacity of the works, and further extensions are in progress.

Edison Swan Electric Co., Ltd.—We reported recently that an offer to purchase their holdings had been made to the shareholders of this company by Messrs. Lescher, Stephens and Co. Now, according to the *Financial News*, those shareholders who accepted the offer have been notified that a sufficient number of acceptances have been received and the purchase will be made immediately. The nominal price of the shares is 4s., and the offer was 13s. per share.

Venezuela Telephone and Electrical Appliances Co., Ltd.—The *Financial News* reports that the directors have accepted an offer from Venezuela for the purchase of the company's undertaking for £425,000. The agreement is subject to the approval of the shareholders, and a meeting will be held shortly to consider the matter. It is anticipated that shareholders will receive at least 27s. 6d. for each £1 share, both ordinary and preference. The sale is recommended by the board, as the offer is considered a favourable one.

Marconi's Wireless Telegraph Co., Ltd.—The *Financial News* says that dissatisfaction among shareholders in this company continues to grow, due to the delay in publication of definite information by the company. "It is understood that a private meeting of some of the principal shareholders is about to be held to consider the position and to press for the formation of a shareholders' committee."

Direct West India Cable Co., Ltd.—For the year ended June, 1926, there was a credit balance of £19,697, as against £12,232 a year ago; £21,537 was brought forward, making £41,234. A final dividend of 5 per cent., free of tax, makes a total of 10 per cent. for the year. £35,234 is to be carried forward. The company's cables have worked without interruption.

Halifax and Bermudas Cable Co., Ltd.—For the year ended June, 1926, the credit balance was £28,322, as against £18,999 a year ago. £44,791 was brought forward, making £73,113. After deducting £5,559 spent on repairs and paying 10 per cent. dividend, free of tax, £62,554 is to be carried forward. The cable was interrupted on one occasion for the removal of an old-standing fault near Halifax.

Ransome & Marles Bearing Co., Ltd.—The profit for the year ended June, 1926, was £39,530, after providing for depreciation and income tax, plus £31,259 brought forward. Turnover again increased; the orders now in hand are very satisfactory. Dividend 7½ per cent., less tax; to general reserve, £15,000; carried forward, £39,000.

Northern General Transport Co., Ltd.—Interim dividends, less tax, as follows:—2½ per cent. actual on the old £1 ordinary; 2½ per cent. per annum as from June 1st, 1926, on the new £1 ordinary; 3 per cent. actual on the 6 per cent. preference shares.

Stock Exchange Notice.—The undermentioned have been ordered to be officially quoted:—

Electrical Distribution of Yorkshire.—500,000 ordinary shares of £1 each, fully paid, Nos. 1 to 500,000.

Bruce Peebles & Co., Ltd.—A dividend at the rate of 7½ per cent. per annum has been declared on the 7½ per cent. cumulative participating preference shares for the half-year ended June 30th last.

Northern Mexico Power and Development Co.—Dividend of 1¾ per cent. on the preference stock for the quarter ended September 30th.

Chadburn's (Ship) Telegraph Co., Ltd.—The directors have decided not to pay the dividend due on October 1st on the 6 per cent. preference shares.

Shanghai Electric Construction Co., Ltd.—A first interim dividend for 1926 at the rate of 4 per cent. actual, less tax, has been declared.

Isle of Thanet Electric Supply Co., Ltd.—The dividend for the half-year ended September 30th on the 6 per cent. cumulative preference shares was to be paid on that date.

Stocks and Shares.

Monday Evening.

Shareholders in London electricity supply undertakings are getting restive at the delay in the settlement of their companies' affairs. These shareholders are almost entirely of the investment class: people who want to know how they stand as regards their stocks and shares. At present, all they have to go upon is the hope that, under reorganised conditions, the dividend returns will be maintained at about the current figures. Recent announcements of the interim dividends have confirmed, by their being at the same rates as those of a year ago, this feeling of confidence. Directors of the companies, if asked to explain the delay, shrug their shoulders and reply that the matter is in the hands of an official Authority; so, "what can you expect?" The Stock Exchange market in electricity shares rests, meanwhile, in a condition approaching enforced stagnation, business being purely of the bread-and-margarine order, although the sales on account of deceased estates are met by a fairly constant demand. Changes are mainly confined, week by week, to insignificant fractions. In the provincial list, Bournemouth and Poole continue to exhibit activity, thanks to the rumours of a possible taking-over of the company by the Corporation. The price has strengthened to 59s. 6d., a gain of 2s. 6d. on the week.

The pleasant suburb of Chiswick is mildly excited by the scheme advocated by the London Joint Electricity Authority for the erection of a large generating station in that borough. The permission of the Electricity Commission will be required. Investors who buy shares for the longer shot, and are content to accept a moderate yield now, in the expectation of their shares growing into money, are the principal supporters of provincial electric issues.

St. James' and Pall Mall shares are 5s. higher, and Westminsters at 2¼ gained 1/16. No other changes have occurred.

The doings of Mr. Alfred Lowenstein continue to arouse very considerable interest. That gentleman has the cleverness to appreciate the heightened attention that comes from any suggestion of mystery, and there is undoubtedly a good deal of curiosity as to his wide-reaching plans in connection with traction, power and other companies. Brazilian Tractions have jumped 4 points to 12, Barcelonas are better at 40¼, Mexico Trams recovered to 16¼, Sidros are quiescent at 12¼. Some of the holders of Mexican Light & Power second mortgage fives are exchanging these, quoted at 90, into Mexican Electric Light 5 per cent. bonds, there being a difference between the two issues of some 27 points. The assumption is that, as the same set of conditions governs both bonds, the disparity between the two "securities" makes the straddle worth carrying out.

Within the near future, there will probably be an issue from the Palestine Electric Corporation, which was first mentioned here nearly three years ago. Lord Reading is mentioned as being the chairman, and the other directors include Sir Hugo Hirst, Sir Alfred Mond, and Mr. James de Rothschild. The capital of the company is £950,000.

British Columbia Electric Railway stocks are better. Anglo-Argentines remain steady. In the British group, London United Tramways debenture has gone back to 44¼, a fall of 2¼ points. Business was marked to-day, Monday, at 43. The preference shares last changed hands at half-a-crown.

Metropolitan Railway Consolidated is 10s. lower at 61½. Underground shilling shares picked up to 12s. The Home Railway list keeps tolerably steady; the retreat of Mr. Cook served to strengthen the impression that the coal-stoppage is within close reach of its termination. Iron and steel shares have firmed up. Babcocks are a good market at 53s. 9d. bid. The cable manufacturing and electrical equipment issues are moving rather irregularly. Siemens have gone back a trifle to 31s. 3d. There was talk, last week, of some of the companies being handicapped by lack of coal. Callenders are better at 3¾. Telephone Manufacturing stiffened to 7s. 9d., which represents a premium of 3d. over the price of the new shares offered last month. The cable stocks are steady, Globes being the only shares to show a decline, which left the price at 19. Cuba Submarine Telegraphs are better at 7¼ and Chili Telephones easier at 6¾. The Direct West India Company has declared a final dividend of 5 per cent., making 10 per cent. free of tax for the year. The Shanghai Electric Construction's interim dividend of 4 per cent., just announced, is 1 per cent. better than that of a year ago. Dollar stocks and shares are uninteresting. Shawinigan Water receded to 232¼.

Marconis have been down to 12s. 3d., but rallied to 13s. 6d. Canadian Marconis obtained a little support at 3s. 9d. The Burndept Wireless Company proposes to issue £50,000 of debentures. Burndept 7½ per cent. preferred stand at 6s. and the deferred at a shilling. Next Monday, the Venezuela Telephone shareholders will be asked to sanction the sale of the company at a price which should give not less than 27s. 6d. per share to ordinary and preference alike. The rubber market has developed noticeable strength, thanks to an improvement in the price of the raw produce. There is a good deal of business doing in the shares.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Sep. 27 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	59/6	+½	5 0 5
Brompton Ordinary	1	10	10	1⅝	—	5 12 2
Charing Cross Ordinary	1	15	15	44/6	—	6 14 10
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	49/6	—	6 1 3
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	58/3	—	5 3 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/-	—	6 3 1
do. 7% Pref.	1	6	7	22/6	—	6 4 5
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	19⅝	—	5 9 1
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅜	+¼	5 6 10
South London	1	15	15	2⅜	—	5 9 1
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	7	1⅜	—	5 17 11
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	2½	+⅛	6 13 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	61½	—½	8 2 8
do. District	,,	3½	3½	51½	—	6 15 11
Underground Electric Ordinary	10	Nil	Nil	2⅞	—	Nil
do. do. "A"	1/-	Nil	Nil	12/-	+6d.	Nil
do. do. Income	Bonds	6	6	100	—	*6 0 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 5
do. Def.	,,	1½	1½	24⅜	—	6 1 3
Automatic Telephone	1	3	10	2⅛	—	3 16 0
Chili Telephone	5	5	6	6¾	—¼	4 7 4
Cuba Sub. Ord.	10	5	5	7¼	+¼	6 18 0
Eastern Extension	10	10	10	19½xd	—	*5 4 8
Eastern Tel. Ord.	Stock	10	10	190½	—	*5 5 0
Globe Tel. and T. Ord.	10	10	10	19	—¼	*5 5 3
do. do. Pref.	10	6	6	11xd	—	5 9 1
Great Northern Tel.	10	22	20	27½	—	7 5 6
Indo-European	25	8½	10	47½	—	*5 5 0
Marconi	1	10	Nil	13/9	—	... ...
Marconi-Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	46/3	—	*5 3 10
United R. Plate Tel.	5	8	8	8¼	—	*4 17 0
Western Telegraph	10	10	10	18⅜	—	*5 7 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3	—	9 3 4
do. do. 2nd Pref.	5	6	8	2½	—	11 3 2
do. do. 5% Deb.	Stock	5	5	76	—	6 11 7
British Electric Traction Ord.	,,	7	8	140	—	5 14 4
do. do. 6% Pref.	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	124	+4	4 0 8
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	96/-	126/9	113½	+1	*5 12 0
do. do. Deferred	,,	129/5	8	140	+1	*5 14 4
do. do. Deb.	,,	4¼	4¼	77½	—	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/-	—	Nil
London United Tram. Deb.	Stock	4	4	44½	—2½	8 19 10
Mexico Trams, 5% Bonds	—	5	5	66¼	—2	7 7 1
Mexican Light Common	100	Nil	Nil	34	—	Nil
do. Pref.	100	Nil	Nil	85½	—	Nil
do. 1st Bonds	—	5	5	70	—	7 2 10
Yorkshire (West Riding)	1	5	—	11/6	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	12	2½	—	4 16 9
British Aluminium Ord.	1	5	10	47/-	—6d.	4 5 1
British Elec. Tr nsformer Pref.	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	3½	—	4 5 9
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3¾	+⅛	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/3	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	31/9	—	6 6 0
Enfield Cable Pref.	1	7½	7½	1⅛	—	6 6 4
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	18/-	—	6 13 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	7½	31/-	—	4 16 9
Henley	1	16	20	4½	—	4 16 10
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	66/3	—	5 5 8
Met.-Vickers Ord.	1	8	8	25/9	—	6 4 9
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	1⅞	—9d.	4 16 0
Telegraph Construction	12	20	10	29½	—	*4 2 0

*Dividends paid free of Income Tax.

The Institution of Public Lighting Engineers.

Annual Conference at Newcastle-on-Tyne.

(*Concluded from page 521.*)

Notes on Street Lighting in Liverpool.

By HAROLD DICKINSON, M.Inst.C.E., M.I.Mech.E., M.I.E.E.

(*Abstract.*)

Liverpool first made a trial of electric-arc lighting early in the 'eighties, but as the experiment was not successful, it was soon abandoned, and it was not until 1896 that a real beginning was made, and a large number of "Brockie-Pell" arc lamps were erected in series. Little progress, however, was made until 1922, when the Lighting Committee considered that the time had arrived for the provision of greater illumination by means of electricity. It was therefore decided to deal with the main arteries, and the mileage of roads electrically lighted rose from 10 in 1922 to 84 at the present time. The lighting of most of the tramway routes in Liverpool was for approximately thirty years carried out by means of two-light incandescent gas lamps, but for some years past these have been considered inadequate, and in 1914 money was set apart to effect an improvement by fixing 300-watt lamps in *lieu*. Originally, the lamps were hung from the existing tramway span wires, but this did not give the best result, and was most unsatisfactory in windy weather. An additional span has therefore been fixed above the existing span wire, from which the lamp is suspended, and to prevent swinging a reel insulator is secured to the bottom span wire, through which the supporting tube passes. We have designed an entirely new fitting embodying new features, which we intend to adopt as our standard. It is designed so that all reflected light rays are directed outwards and downwards, and when fitted at a height of 20 ft. and 40 yards apart, the reflected light rays from adjacent lamps just overlap. The sleeve is in two sections, the upper one capable of being lowered, and the lower portion capable of being raised, giving free access to the internal portion of the fitting.

A strictly economic treatment only has been attempted in most of the roads, but reference may be made to the more brilliant illumination in Lord Street and Church Street. Formerly, the lighting was carried out by means of "Brockie-Pell" arc lamps fixed 28 ft. above the ground in "Hyde Park" carriers, and on alternate tramway poles planted in "staggered" fashion, about 40 yards apart. These were ultimately displaced by 500-, later increased to 750-W, gasfilled lamps. In some of the positions, however, the overhead span wire carrying the lamp is attached to lengthening pieces, inserted in the tops of the tramway poles. In recent years Liverpool has constructed many miles of exceptionally good roads, most of them being 120 ft. wide, one being as much as 220 ft. wide. In some of these roads a tramway track is laid in the centre and the steel poles have been utilised for lighting purposes, long brackets of 1½-in. w.i. tube being clipped to the poles. These are approximately 40 yards apart, and the lamps (usually 100-W gasfilled in vitreous enamelled reflectors) attached to alternate poles, are at such a height that the point of light is 20 ft. from the ground, extending 6 ft. over the carriageway.

For the lighting of new roads on the housing estates, the equipment used is the ordinary lamp pillar, with a swan neck fitting, the height of the 60-W lamps from the ground being 11.2 ft., and their average distance apart does not exceed 50 yards.

It has always been customary in Liverpool to reduce the street lighting at about midnight. The larger units, from 1,000 to 300 W, are extinguished and 60-W gasfilled lamps lighted in lieu, but in the new arrangements it is the practice to extinguish alternate lamps, where possible.

The Lighting Department provides the entire equipment, but the cost of giving the supply is largely borne by the Electricity Supply Department, which supplies and erects the iron clamps, insulators and copper span wires in connection with overhead wiring, and connects from the mains to the switch box and between the poles at its own expense. The average cost per lamp for all types of lighting has been £7. The price paid for electricity for street lighting purposes is 2d. per kWh for the first 70,000 kWh per quarter, and 1d. for all consumption above that figure, plus 25 per cent.; the average price paid last year was 1.56d. per kWh.

For overhead wiring the Electricity Commissioners require the two lower wires, two pairs being used, to be bridged across at intervals to form a cradle and connected to the neutral of the supply system. The two upper wires then form the "all night" and "midnight" switching leads, protected by the neutral-wire cradle. In many main roads such wiring constitutes a great hindrance to the operations of the fire brigade, and side wiring is inadmissible if the buildings are much over 30 ft. in height. The question is one we now settle by consultation with the Chief of the Fire Brigade. The running of a centre line is naturally much more expensive than side wiring, as the bulk of the work has to be carried out from a tower wagon when traffic permits—usually between midnight and 6 a.m. Ordinary v.i.r. cables—taped and braided—"Ancalite" and C.T.S. cables, have been used where covered conductors are necessary, but in such situations "Maconite" unbraided cables are now used entirely. The centre line used in many instances consists of a 7/14 galvanised-steel cable supported on insulators bolted on to an upper 7/12 steel span wire. The insulated cables (usually one 7/.036 in. and two 3/.036 in.) are taped to the street centre line with proof tape at intervals of 15 to 18 inches. A binder of 14 gauge copper wire was at one time used round the taping; but now clips of 20-gauge annealed aluminium are used.

Through joints in the cables are made at each span wire, but are left unsoldered so as to make disconnection easy in the event of having to locate a fault.

In order to reduce the amount of unprotected steel wire to a minimum, several centre lines have been run in which a hard-drawn twin, 7/.036-in. "Maconite" cable has buckled to it a single 3/.036-in. wire; alternatively, three hard-drawn 7.036-in. cables are used, the three single cables being taped and buckled together. The conductor, being hard-drawn and having a breaking strain in excess of the Electricity Commissioners' requirements, does not require any steel-supporting cable. Some triple "Maconite" (7/.036 in.) has also been tried and found satisfactory; the centre cable has one wire of steel and the remaining six of copper; the two outer cables are each built of four steel and three copper. The idea of having composite cables of steel and copper was given up, as it was thought that should any water enter the cable strand, the dissimilar metals might set up corrosion.

Where tramway poles are "staggered" to obtain better distribution of light, the spans are not then at approximately right angles to the direction of the road, and a new type of fitting to grip spans for support of centre lines becomes necessary to allow for any variation in angle. A fitting was made up consisting of two galvanised mild steel plates, sheradised steel bolts and two castings. The castings used first were of gun metal, but galvanised malleable castings were obtained later. This is now our standard fitting for gripping any span wire.

In the suburbs where overhead wiring is installed, we are fixing a 10-A time switch to control as many as 50 100-W lamps, and so far we have found them satisfactory.

Discussion.

Mr. LANGLANDS (Glasgow) said there was no doubt that progress electrically must proceed along the lines of overhead wiring because the question of cost had to be considered. He did not like lamps hung on wires; in Glasgow they hung the lamps at both ends of the arms of the tramway standards.

Mr. CRAMB (Croydon) voiced the opinion that overhead construction should be avoided wherever possible. Regarding the cost, he was not sure if, over a period of years, there was any difference between the original cost of underground and overhead systems. The removal of the network of overhead wires would considerably improve the appearance of the streets of the towns up and down the country.

Mr. LENNOX (Newcastle-on-Tyne) expressed the opinion that, compared with the cost of underground wires, the overhead system would be about half the cost, and if there were poles which could be utilised, the costs would be further reduced. Improvement in the lighting could be effected by "staggering" the poles, and it would be an economy if service wires were laid to supply the second side of the road. It would also, in his opinion, be cheaper to use single insulated straight-line with mechanical clamps attached, instead of the double shackle arrangements of each pole.

Mr. DICKINSON pointed out that they met many difficulties with cables under pavements, one being the difficulty of keeping a straight line. They would not have the overhead wires for lighting purposes from the point of appearance, but there was the question of costs to be considered.

Exhibition of Lighting Appliances.

One pleasing feature connected with the meeting was the manner in which the exhibition of lighting appliances had expanded.

The stand of the General Electric Co., Ltd., was prominent, and a special feature on it was the "Wembley" lantern, designed in two sizes, to accommodate Osram gasfilled lamps of from 300 to 500 watts, and from 1,000 to 1,500 watts, respectively. It is equipped with a prismatic single piece glass refractor and white over-reflector, the lamp and refractor being protected by a clear glass outer globe. The "Pearl" (inside frosted) Osram lamp was shown.

The British Thomson-Houston Co., Ltd., provided a striking display of street lighting, including about 20 different types of lanterns, street poles, and wall and pole brackets. Special attention was drawn to its "White way" lighting for decorative street illumination, and four examples of this system were displayed. All the fittings were equipped with Mazda lamps. Another interesting exhibit was the basket lantern of copper with a rippled pine-shaped globe.

Messrs. Cable Accessories Co., Ltd., gave prominence to their street lighting fittings, one being a new open-type reflector designed in conjunction with and for Liverpool Corporation Lighting Department, the new features being two s.p. 5-amp. fuses mounted on a plate carrying the lampholder, which is capable of adjustment from outside. Another point is that the sleeve, which is in two portions, is capable of being raised or lowered for easy access to both lampholder and fuses. The fittings are designed for from 60- to 1,000-W lamps.

On the stand of the Siemens and English Electric Lamp Co., Ltd., was a selection of specially designed fittings and switchgear for street-lighting purposes. One noteworthy exhibit was some "Silvalux" oval, gasfilled lamps made with two-ply glass bulbs having an inner lining of clear glass and an outer casing of pure white opal glass. These are designed for diffusive illumination and avoidance of glare. "Purlite" lamps were also shown, both gasfilled and vacuum types; these are internally frosted.

Messrs. Venner Time Switches, Ltd., Horstmann Gear Co., Ltd., displayed various types of time switches of excellent character of workmanship.

A selection of street-lighting refractors and lanterns was shown by Messrs. Holophane, Ltd.; their stand was lighted by a 100-W two-way refractor in a cast-iron lantern, a 500-W four-way refractor in a spun-copper lantern, and a 200-W three-way refractor in a lantern of the first mentioned type. A conspicuous feature was a large ornamental refractor adopted for park or promenade lighting. The latest asymetric dome-type refractor also was on view.

Colour merging was a feature at the stand of Messrs. Metro-Vick Supplies, Ltd., who devoted special attention to means for better shop lighting. Examples of the appliances used in street lighting at Brighton and Paisley also had a place.

Another stand was that of the Electric Street Lighting Co., which displayed the "Croydon" fitting for converting a gas lantern, and the "Croydon" canopy reflector. The reflector fittings of the Benjamin Electric Co., Ltd., made an attractive display.

At the stand of the Photector Co., Ltd., were several examples of street lighting units of modern design, including the "Unilux." One of the principles aimed at in the design of this apparatus is even illumination between any two units. It employs two prismatic refractors and a suitable reflector. This is seated well within its reflector, so that glare is eliminated, while a prismatic glass lining ensures an even distribution of light.

As a feature of special interest on this stand was a new arc lamp, specially designed for the illumination of main thoroughfares. This lamp, the "Lia" long-burning flame-arc lamp, is said to have a burning period of about 120 hours per trim on one pair of carbons, and an illumination of about 20-30 lumens per watt.

The general completeness of the exhibition as a whole was most favourably commented upon by many visitors.

During the conference Mr. Alexander F. Cramb, M.I.E.E. (Croydon), was appointed president-elect, and Messrs. S. B. Langlands (Glasgow), C. F. Shapley (Leeds), and C. J. Winston (London) were elected to fill vacancies on the Council. On the invitation of Mr. John Christie, of Brighton, it was agreed to hold the next conference at Brighton.

Votes of thanks were passed to the Lord Mayor and Corporation of Newcastle for their hospitality and the use of 'buses; to those who had read papers, the president, officials, and members of the Council, and the manufacturers who had provided stands at the exhibition of lighting appliances.

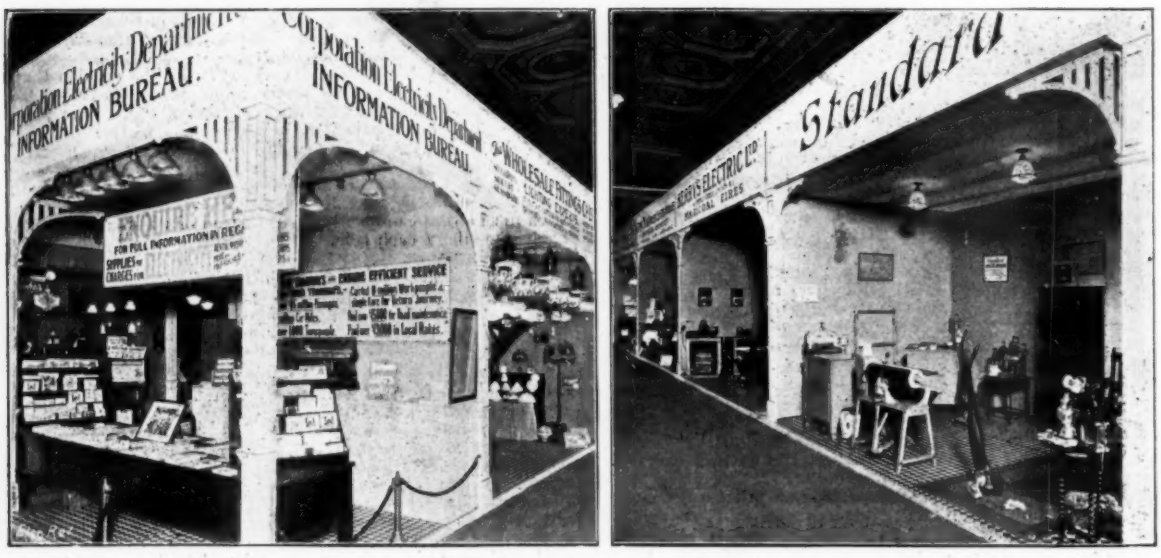
The West Ham Electrical Exhibition.

At the electrical exhibition recently held at the Stratford Town Hall, under the auspices of the West Ham Corporation Electricity Department (engineer and manager, Mr. F. W. Purse), brief mention of which was made in our issue of September 17th last, the Electricity Department occupied two stands, one where lessons and demonstrations in electric cooking were given by Mrs. L. Hollis, lady demonstrator to the department, and the other serving as an inquiry bureau from which visitors were supplied with details of the favourable terms for supply and the hire or hire-purchase of domestic appliances, &c. Information was also given to visitors resident outside the Council's area regarding the voltage, terms of supply, &c., in their districts. The growth of the undertaking is shown by the increase of consumers from 439 with a total consumption of 1,246,585 kWh in 1901 to 7,043 consumers with an output of over 77 million kWh in the past year. An interesting feature of the Corporation's propaganda is the monthly issue of a "Power and Factory Gazette," in which details of vacant factory premises are given, together with the Corporation's scale of charges for lighting and power, with a view to inducing manufacturers to open up works in the borough. The publication also includes a number of illustrations of factories to which the Corporation provides an electricity supply.

The charges for electricity supply in the borough are:—Lighting (excluding pre-payment meter supplies), 4½d. per kWh; heating and cooking, 1½d. per kWh; special factory lighting rate, to the extent of 10 per cent. (for quarterly accounts) or 15 per cent. (for monthly accounts) of consumption for power, 3¼d. per kWh; power, 3½d. per kWh for the first 40 kWh per quarter per h.p. installed, and 1½d. per kWh for all energy in excess of this amount. These charges are subject to a discount of 5 per cent., for prompt payment of accounts.

A large variety of well-displayed domestic appliances was exhibited by leading electrical firms. The Jackson Electric Stove Co., Ltd., showed cookers and "Perco-Wash" boilers; the General Electric Co., Ltd., exhibited an extensive range of "Magnet" appliances; Artofex Engineering Works, Ltd., displayed electrical equipment for bakeries, including an electric oven, and mixing machines; "Supastone" lighting glassware of various colours and design was shown by the Wholesale Fittings Co., Ltd.; Berry's Electric, Ltd., made a special feature of their "Magicoal" fires; the Hotpoint Appliance Co., Ltd., exhibited "Hotpoint-Falco" cookers, &c.; "Cosmos" domestic appliances were shown by Metro-Vick Supplies, Ltd.; Standard Telephones & Cables, Ltd., were responsible for washers, ironing machines, &c.; electric fires, irons, cookers and other appliances were exhibited by Belling & Co.; and Drake & Gorham Wholesale, Ltd., had refrigerators, vacuum cleaners, toasters, &c. The E.L.M.A. had a miniature shop-window display and ancient and modern methods of lighting were effectively compared.

Throughout the week lectures and demonstrations on "Electricity in the Home" were given by members of the E.L.M.A. and the Electrical Association for Women.



Some of the Exhibitors' Stands at the West Ham Electrical Show.

A Unity-Power-Factor Motor.

The G.E.C. "All-Watt" Induction Machine.

In response to the demand for a compensated-type induction motor having a high inherent power factor, the General Electric Co., Ltd., has recently designed and developed the "All-Watt" motor to give the desired results, which are obtained by incorporating in the motor an exciting device, consisting of a commutator connected to a low-voltage winding similar to the exciter armature of a synchronous machine, the principle being shown in fig. 1. Referring to this diagram, the stator winding A, rotor winding B, and slip rings C, are identical in every way with the corresponding parts of an ordinary

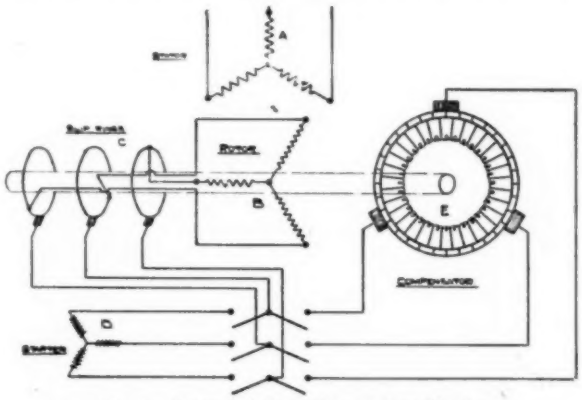


Fig. 1.—Diagram of Connections of New Machine.

induction motor. The new machine can be connected to either the starting resistances D, or when these have been cut out, to the compensator E.

The compensator is really a phase advancer built into the machine, its winding consisting of a few turns of heavy-gauge wire. This winding is never subjected to high pressures, thus rendering it practically immune from electrical breakdown. The addition of a commutator may appear on first consideration to be a retrograde step, but at the low voltage employed it will run satisfactorily for long periods without attention, sparking being non-existent. The commutator and exciting winding are disconnected entirely during the starting period, and the starting operation is similar to that for the ordinary induction motor. When the machine has reached full speed, the compensating device and commutator are automatically switched in by moving the starting switch to

Fig. 2.—Complete "All-Watt" Motor.

the final position. When the compensating device is connected in series with the rotor, a magnetising current is sent through the winding sufficient to supply the excitation of the machine. No wattless current will be taken from the line at normal working range between ¾ load and 25 per cent. overload. On half load, however, there is a small wattless current, but a high power factor is maintained. Fig. 3 shows comparative power factor curves for a 25-h.p. "All-Watt" motor and an ordinary induction motor of the same capacity. The patented compensating device does not in any way, it is claimed, interfere with the reliability and simplicity of working of the motor, while the "pull-out" torque is increased, and the size of the motor is not increased.

Tariffs which give advantageous terms for a high power factor are usually on the basis of: (*a*) a standing charge per kVA maximum demand, plus a charge per kWh consumed; or (*b*) a charge per kWh consumed, with a rebate for a power factor above a certain value. It will be interesting to compare the power costs for the new and ordinary types of motors when running on these two typical tariffs. The following data refer to two 25-h.p. motors, each running at 720 r.p.m. on a three-phase, 50-cycle system, for a period of 3,500 hours per annum. The charges for tariff (*a*) are taken as £5 per kVA, maximum demand per annum, plus 0.6d. per kWh consumed, and for tariff (*b*) 1d. per kWh, with a rebate of 7½ per cent. when the power factor exceeds 0.9.

For the induction motor, efficiency 86 per cent., power

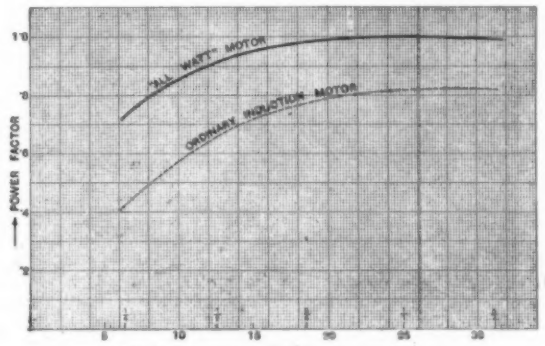


Fig. 3.—Comparative Power-factor Curves.

factor 0.82, the standing charge on tariff (*a*) for 26.5 kVA is £132, the running charge for 21.7 kW being £190, making a total of £322. For the "All-Watt" motor, efficiency 86 per cent., power factor 1.0, the standing charge on tariff (*a*) for 21.7 kVA is £108, the running charge for 21.7 being £190, making a total of £298.

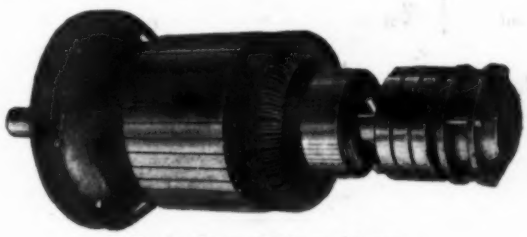


Fig. 4.—Rotor with Phase Advancer.

The cost of energy for each machine on tariff (*b*) is 21.7 kW ×3,500×1d.=£316, on which the "All-Watt" motor will earn a rebate of £23 14s.

Figs. 2 and 4 show, respectively, the complete motor, externally, and the rotor unit with the "phase advancer."

B.E.S.A. Publication.—The British Engineering Standards Association has recently issued a specification for electric cable soldering sockets, No. 91-1926. This was originally issued in 1921, and the present publication is a revision which makes better provision for sockets for use with either paper-insulated or rubber-insulated cables. Otherwise it is similar to the old edition, with the exception that a few additional sizes are included in the list of cast lug sockets and tubular lug sockets. A certain number of these sizes are marked as primary and are recommended for adoption wherever possible, the remaining sizes being marked as secondary and are intended to be used only in cases where it is not immediately convenient to employ primary sizes. In this way it is hoped to be able at some future time to reduce the number of standard sizes to the present number of primary sizes, thus considerably simplifying the keeping of stocks. Each size of lug socket is obtainable in three types, according to the angle of inclination of the palm of the socket. Copies of this publication can be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 1s. 2d. post free.

Destructive Woodpeckers. — Telephone and telegraph poles are being destroyed by thousands annually in parts of Canada where oak trees are numerous. Woodpeckers drill holes in the poles, placing green acorns in them. In wet weather the acorns swell, causing the poles to split.—*Reuter* (Ottawa).

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

The "P. & R." Accumulator.

There are now a number of makes of accumulator to choose from when replacing the high-voltage dry battery in the plate circuit of a receiving set. One of the latest to make its appearance is that of the Pritchett & Gold and E.P.S.. Co., Ltd. (incorporating Peto & Radford), the design of which is somewhat unconventional. Each cell is of 2 volts 3 Ah capacity, and the cell cases are made of "Dagenite," each block of 10 V (5 cells) being moulded in one piece, as shown in fig. 1; these blocks are normally assembled in enamelled wood cases, the complete 60-V, 180 watt-hour battery being shown in fig. 2. Each cell is provided with a top flange

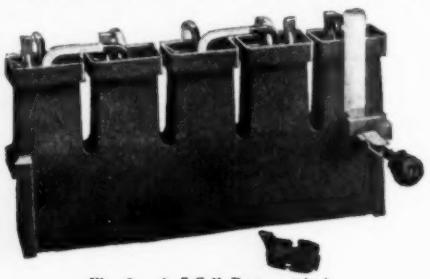


Fig. 1.—A 5-Cell Battery Block.

having a recess moulded on its under side, which ensures similar insulation to that provided by the ordinary type of telegraph insulator; this, and the air gap between individual cells, are the principal means relied on to minimise surface leakage, but the inter-connection of cells is also so arranged that the maximum potential difference between extreme terminals of adjacent cells is no more than 12 V in a 60-V set. The method of suspending the blocks inside the wood case is worth noting: moulded on to both ends of each "Dagenite unit block" is a short flange, which rests on a bearer bar inside the wood case, at the bottom of which is a chemically-treated pad which neutralises any acid that may be spilled over. The plates are of the interlocking lattice-grid

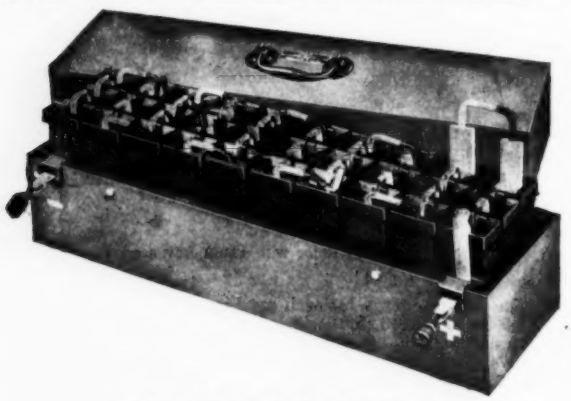


Fig. 2.—"P & R." 60-V Accumulator.

pattern, cast and burned together in pairs and connected by solid pure lead bars; each is 3/16 in. thick, and each positive one has an active-material surface area of 4 sq. in. The unglazed porous porcelain separators are grooved vertically on the negative side to permit the free passage of gas, and are so constructed as to hold the plates off the floor of the cell and provide a "tunnel" beneath them for the circulation of the electrolyte. The separators are also so formed that, should a pair of plates be removed for inspection, they cannot be replaced the wrong way round. Screw-down terminals and a wander-clip for tapping 2-V stages are provided, as well as a lid for each cell (one is shown beneath fig. 1), whilst the polarity of the plates of each cell and of the extreme terminals is clearly marked.

Sievert Coils.

We have received an interesting example of efficient coil winding. The coil consists of enamelled copper wire cylindrically wound and impregnated in a way that makes it difficult for the wire to work loose or become entangled when subjected to shock and careless treatment. Our sample has a square centre hole, and at first sight resembles a thick washer; such coils are very rigid. They can be supplied by the Sieverts Kabelverke, Sundbyberg, Sweden (representatives in Great Britain and Ireland: Messrs. James McMillan and Co.), to any specification for meeting the needs of manufacturers of a wide range of radio and other electrical apparatus. A coil's weak point is usually that where the coupling is made, generally by means of special fastening wires soldered to the ends of the enamelled wire; a good mechanical joint is thus obtained, but the soldering operation introduces stresses which may be injurious. The coils under review, however, do not need soldering, and the strength of the ends is up to 4 lb. Amongst the uses of such coils is the construction of low-frequency radio transformers, as shown in fig. 3; the coils are indicated as being separated by insulating paper, and each of the two coils P has 1,500 turns of 0.0044-in. and each of the two S coils 4,500 turns of 0.0028-in. enamelled

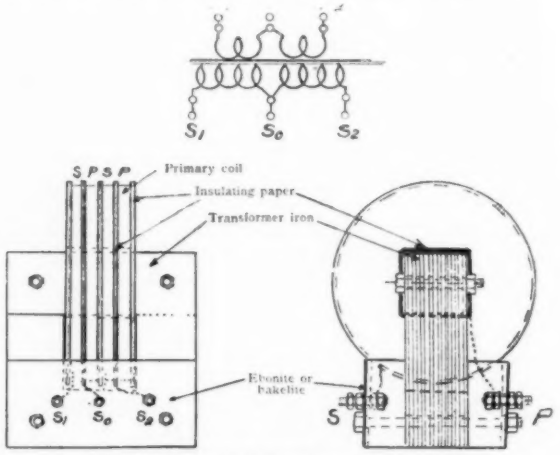


Fig. 3.—Sievert Coil Transformer Construction.

wire, the ratio being 1:3. Such a transformer can be very easily repaired by the user himself substituting a new coil for a faulty one. Finally, the makers accentuate the possibility of using these coils in "balanced" low-frequency transformers where the secondary winding is parted in two halves with a connection from the "dividing point." The winding S_o-S_1 must have a resistance equal to that of the winding S_o-S_2; this can easily be made by measuring the resistance of a series of coils and pairing together those of equal resistance. If very exact conformity between both of the windings is wanted, it can be attained by putting two coils in each of the windings S_o-S_1 and S_o-S_2, so that the sum of the resistance of S_o-S_1 is equal to that of S_o-S_2. This is one of the reasons why the coils are being made as thin as possible.

A Hospital Installation.

The Leatherhead Cottage Hospital's radio receiving set will go a long way towards the alleviation of the dull monotony of everyday hospital life for both patients and staff alike. The installation, which was planned and carried out by Messrs. Buchanan & Curwen, of Leatherhead, consists of a cabinet of two compartments, each fitted with double doors. A B.T.-H. standard 2-valve l.f receiver, as illustrated in fig. 4, employing a detector valve followed by a stage of l.f. power amplification and two d.p. change-over switches, are mounted in the upper section, whilst 6-volt, 40-Ah and 120-volt accumulators and a small grid-bias battery are housed in the lower section. A

Fig. 4.—A B.T.-H. Standard 2-Valve Receiver.

novel feature is the fact that a B.T.-H. B4 power valve is used for detection, as well as in the amplifying circuit. This valve has been found to give most excellent results as a detector. Wall sockets designed to receive ordinary headphone tags are arranged at frequent intervals throughout the wards and staff rooms and thirty-six pairs of B.T.-H. headphones have been provided. The wiring to the sockets is concealed within the walls and is on a series-parallel system, so arranged that when the set is switched on, the points in the private wards and staff rooms are always in circuit, whilst those in the men's and women's wards may be controlled by the two d.p. switches.

A Modern Theatre Electrical Installation.

The Equipment at the New Plaza Theatre.

One of the most interesting electrical installations of recent years is that at the palatial Theatre of the Film, the Plaza Theatre, London. The main electricity supply to the theatre is taken from the h.p. mains of the St. James and Pall Mall Electric Light Co., which has installed duplicate banks of Scott-connected air-cooled transformers, each having a capacity of 200 kVA, and being controlled by truck-type oil-switch gear. The whole of this equipment is contained in a special fireproof chamber. The l.p. side is fed through a 6-pole double-throw switch, the connections of which make it impossible to load more than one bank of transformers at one time. The l.p. feed cables are taken to two industrial-type switchboards, each having its own busbar chamber, below which the supply authority's meters are fixed. This supply provides for the lighting only, a second service at 440/220 V, d.c., dealing with the power requirements.

The stage equipment is perhaps the most interesting of any of the London film theatres, by means of which some wonderful lighting effects can be obtained.

Fig. 1.—The Stage Switchboard.

The switchboard serving the stage, which was manufactured by the Westinghouse Electric Co., is claimed to be the first of its kind to be installed in this country. It is arranged in three sections: a pilot or control board, from which all switching and dimming is carried out; a contactor board; and a fuse panel.

All switching is carried out at a pressure of 110 V, transformers being installed for this purpose. The contactors are of unusual design, being mechanically-electrically operated. Once a contactor is closed, the operating circuit becomes de-energised by the opening of an auxiliary switch, and the contactor is held closed by mechanical means.

The opening and closing contactor circuits are separate, and are each controlled by a d.p. double-throw switch on the pilot board. The switches are arranged in double rows—close top, open bottom. No switch can be used for an operation for which it is not intended.

The other throw of the switches is for the purpose of master switching and pre-selecting of circuits; it is possible to set up two distinct lighting plots during rehearsal and repeat them subsequently at will by the operation of one switch only (grand master) Sub-master or colour master switches act in the same way. The "black out" is effected by means of a push button, which closes a multi-contact relay, thereby opening simultaneously all the contactors which are closed. The contactors can be reset by one operation of the master

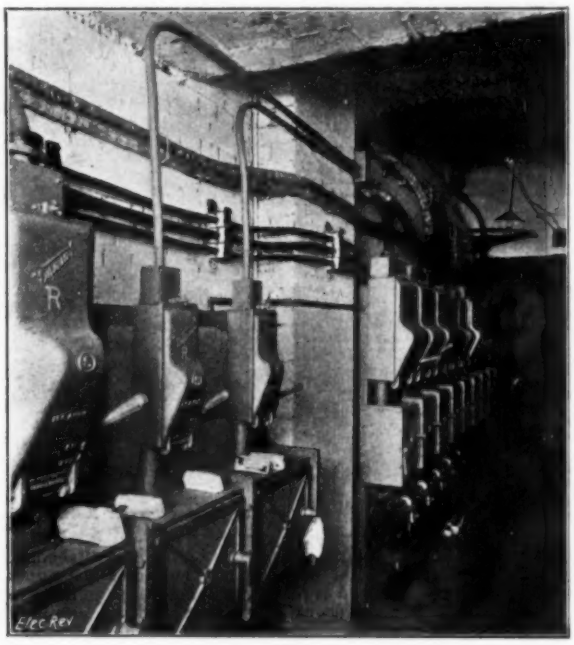


Fig. 2.—Supply Intake Chamber.

switch. Another feature of this board is that after the circuits have been fixed, they can be "locked" in such a manner that no unauthorised person can disarrange the "set up." The dimmers, which are of the Ward-Leonard type, are also provided with the master-control feature.

The stage is equipped with "Samoiloff" magazine-type float and surround lighting strips, and three magazine-type battens of non-tarnishable metal reflectors are provided. The "Schwabe" lighting system of the General Electric Co., Ltd., complete with the artificial horizon or "Cyclorama," is also installed, and consists of a battery of 36 1,000-W gas-filled horizon flood lamps, with various coloured screens which can be so blended as to give striking colour effects on the

Fig. 3.—Electrolier Lighting, Grand Foyer.

horizon. An interesting feature is a cloud apparatus by means of which pictures of moving clouds can be shown. The usual stage plugs are provided, and these are also controlled by the "Westinghouse" board. A full view of the stage can be commanded from the control room.

Electricity for the projection and front-of-house arcs is furnished by three motor-generator sets, one of 30-kW and

two of 15-kW capacity. The motors of these machines are fed from the 2-phase supply. The generators are compound wound, and a switchboard is provided by which all machines may be paralleled as required; each machine is provided with a Whipp & Bourne circuit breaker fitted with overload, no-volt, and reverse-current trips.

The main projection room is probably one of the most up-to-date and fully equipped in the country, and is equipped with three modern "Simplex" projectors, two "Simplex" focus and flood arcs for "spotting" or "flooding," and a

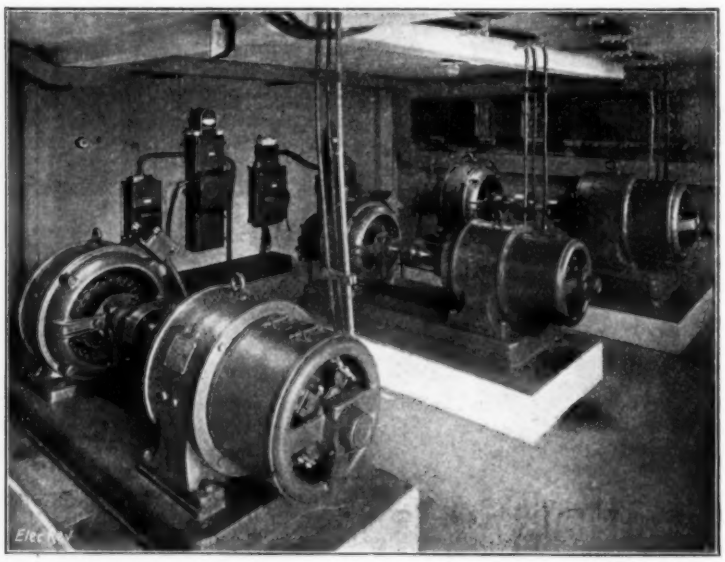


Fig. 4.—The Motor-generator Room.

new-pattern "Stereopticon" lantern. A main switchboard in this room controls the supply from the motor generators and to the projectors, and is fitted with pilot lamps to indicate which machine is running at any time; and an auxiliary switchboard accommodates the control gear for the arcs. The projection machines are fitted with electrically-operated speedometers, and a speedometer on the musical director's desk in the orchestra can be connected at will by the operator to any machine.

It is interesting to note that a small private theatre and projection room enable films and effects to be tried out without interfering with the normal working in any way.

The main auditorium lighting is effected by lamps concealed above glass fitted into the ceiling. This gives a very pleasing result, and it is interesting to note that no reflectors are used for the lamps; the space above the ceiling is very small, and different types of reflectors were tried with poor results. In addition, pleasing effects are obtained from handsome lanterns and wall brackets, and in particular by very fine electroliers of French design in bronze doré and moulded glass, the latter, when lit, having a mother-of-pearl appearance. Remarkable colour effects are obtained from these fittings on the rich decorations of the house.

The lighting of the "front-of-house" foyers, vestibules, grand staircase, and passages is done by special fittings, in keeping with the character of the architecture. One of the features of the house is the arrangement for "spotting" artistes from a platform built above the main ceiling; four flood and focus arcs are provided on this platform, which enable novel lighting effects to be obtained.

The main exterior lighting is effected by eight large wrought-iron lanterns on both fronts of the building. The walls are flood lighted from the first floor balconies, and the dome is "flooded" from the opposite side of Regent Street. In addition, a battery of 16 500-W lamps is installed in the cupola on the top of the dome.

As an indication of the magnitude of the lighting installation, it is worthy of note that there is a total of 4,000 lamps of various sizes. The total connected load amounts to 506 kW, of which motors and motor generators account for some 171 kW.

The theatre has been equipped with a complete internal automatic telephone system by Messrs. Standard Telephones and Cables, Ltd. A complete system of watchmen's tell-tale clocks is also provided for the fireman's use. A "Princeps" synchronised electric clock installation, with dials in the auditorium, foyers and offices, is another feature. Electrical resistance thermometers throughout the building are connected to the boiler house.

The larger cables used, from .04 sq. in. twin or 3-core upwards, are of the paper-insulated, lead-covered, steel-tape-armoured type, and were manufactured by Messrs. Standard Telephones and Cables, Ltd., whilst the whole of the v.i.r. cable, of which some 34 miles is used, was supplied by Messrs. Johnson & Phillips, Ltd. The motor generators were manufactured by The Metropolitan-Vickers Electrical Co., and the majority of the lamps employed are of the "Cosmos" make. The contractors for the whole of the electrical work were Messrs. Tredegars (1923), Ltd., who carried out the work under the personal supervision of the company's engineer, Major Charles H. Bell, O.B.E.

We are indebted for the particulars given above to Mr. C. W. Rabbetts, the contractor's engineer responsible for the work.

Fig. 5.—The Auditorium.

Fig. 6.—Corridor Lighting.

British and German Industrialists to Confer.—A *Reuter* dispatch from Berlin reports that a conference is to be held in London in October between British and German industrialists, for the purpose of establishing contact between the leaders of both countries. This is the result of discussions which have been proceeding for some time between Herr Duisberg, chairman of the League of German Industrialists, and Sir Max Muspratt, of the Federation of British Industries. The question of British participation in the proposed Continental Steel Trust between German, French and Belgian manufacturers, and similar questions, will not be among the subjects for discussion.

Electrical Exports of the United States.

Below are shown the values of electrical machinery and apparatus exported from the United States during the twelve months ended June last. Comparative figures for the twelve months ended June, 1925, are added and notes of increases or decreases are given.

	Twelve months ended June, 1925. Value. $	June, 1926. Value. $	Inc. or dec. $
Electrical machinery and apparatus (total) ...	66,871,000	80,676,000	+13,805,000
Generators—			
Direct current—			
Under 500 kW	876,000	874,000	− 2,000
500 kW and over ...	551,000	410,000	− 141,000
Alternating current—			
Under 2,000 kVA ...	219,000	251,000	+ 32,000
2,000 kVA and over ...	1,115,000	2,068,000	+ 953,000
Steam turbine generator sets	429,000	1,164,000	+ 735,000
Accessories and parts for generators	1,079,000	1,126,000	+ 47,000
Self-contained lighting outfits	879,000	1,057,000	+ 178,000
Batteries—			
Flashlight batteries ...	1,065,000	1,257,000	+ 192,000
Other primary batteries	941,000	1,641,000	+ 700,000
Storage batteries ...	2,661,000	3,087,000	+ 426,000
Transforming or converting apparatus—			
Power transformers ...	2,086,000	2,102,000	+ 16,000
Other transformers ...	1,525,000	1,145,000	− 380,000
Rectifiers, double-current and motor generators, dynamotors, synchronous, and other converters	1,110,000	1,153,000	+ 43,000
Transmission and distribution apparatus—			
Switchboard panels, except telephone	2,018,000	2,922,000	+ 904,000
Switches and circuit breakers over 10 amps.	1,835,000	2,724,000	+ 889,000
Fuses and fuse blocks ...	284,000	354,000	+ 70,000
Watt-hour and other measuring meters ..	486,000	478,000	− 8,000
Volt-, watt- and ampere-meters, and other recording, indicating and testing apparatus ...	1,565,000	1,870,000	+ 305,000
Lightning arresters, choke coils, reactors, and other protective devices	646,000	742,000	+ 96,000
Motors, starters, and controllers—			
Motors under 1 h.p. ...	1,703,000	2,132,000	+ 429,000
Stationary motors—			
1 to 200 h.p.	1,957,000	3,101,000	+ 1,144,000
Over 200 h.p.	443,000	858,000	+ 415,000
Railway motors	825,000	785,000	− 40,000
Electric locomotives—			
Railway	1,210,000	1,460,000	+ 250,000
Mining and industrial	240,000	607,000	+ 367,000
Starting and controlling equipment—			
For industrial motors...	1,101,000	1,283,000	+ 182,000
For electric railway and vehicle motors...	141,000	240,000	+ 99,000
*Portable electric tools ...	—	259,000	—
Accessories and parts for motors	1,776,000	2,667,000	+ 891,000
Electrical appliances—			
Electric fans	812,000	875,000	+ 63,000
Electric lamps—			
Metal filament	1,135,000	1,402,000	+ 267,000
Other electric lamps ...	335,000	229,000	− 106,000
Flashlights	1,056,000	1,794,000	+ 738,000
Searchlights and projectors	431,000	527,000	+ 96,000
Motor-driven household devices	1,040,000	1,379,000	+ 339,000
Domestic heating and cooking devices ...	1,231,000	1,476,000	+ 245,000
Industrial electric furnaces and ovens ...	225,000	247,000	+ 22,000
Therapeutic apparatus, X-ray apparatus, galvanic and faradic batteries, &c.	1,192,000	1,498,000	+ 306,000
Signal and communication devices—			
Radio apparatus	8,273,000	5,835,000†	—
Transmitting sets and parts	—	340,000*	—
Receiving sets	—	886,000*	—
Valves	—	401,000*	—
Receiving set components	—	752,000*	—
Receiving set accessories	—	869,000*	—
Telegraph apparatus ...	553,000	602,000	+ 49,000
Telephone apparatus—			
Magneto telephones ...	173,000	120,000	− 53,000
Other telephones ...	400,000	430,000	+ 30,000
Telephone switchboards	987,000	1,782,000	+ 795,000
Other telephone equipment	2,440,000	2,312,000	− 128,000
Railway signals, switches, and attachments ...	920,000	547,000	− 373,000
Bells, buzzers, annunciators and alarms ...	171,000	238,000	+ 67,000
Other electrical apparatus—			
Spark plugs, magnetos, and other ignition apparatus	2,247,000	2,398,000	+ 151,000
Insulating material ...	1,440,000	1,546,000	+ 106,000
Metal conduit, outlet, and switch boxes ...	655,000	1,012,000	+ 357,000
Sockets, receptacles and lighting switches ...	1,353,000	1,684,000	+ 331,000
Electric lighting fixtures, interior and street ...	990,000	1,721,000	+ 731,000
Other wiring supplies and line material	1,011,000	1,259,000	+ 248,000
Electrical apparatus n.e.i.	7,036,000	7,097,000	+ 61,000

* January 1st—June 30th. † July 1st—December 31st.

Electric lamp exports were distributed as follows:—Europe $27,000, Canada $19,000, Central America $86,000, Mexico $268,000, British West Indies $22,000, Cuba $161,000, Argentina $190,000, Chile $100,000, other South American countries $169,000, Australia $132,000, New Zealand $45,000, British South Africa $21,000.

Fluid Fuels.

In the course of the paper read before the Institution of Fuel Economy Engineers, on Friday last, by Mr. A. E. Dunstan, D.Sc. (Chief Chemist, The Anglo-Persian Oil Co., Ltd.), the author stated that although the world's production of petroleum in 1925 amounted to the enormous volume of 142 million tons, yet since the beginning of the industry only about two-thirds of a cubic mile of petroleum had been mined and distributed. The largest producer was the United States; in 1925, 99,300,000 tons was produced; Mexico followed with 17,000,000 tons; Russia with 6,700,000 tons; Persia with 4,500,000 tons; Dutch East Indies with 3,000,000 tons; Rumania 2,240,000 tons, now increased nearly 50 per cent.; and India 1,150,000 tons; other centres producing quantities less than a million tons per annum. The ratio of coal to oil produced was very big (9.3 in 1925).

The number of motor-cars, trucks, and motor-cycles registered on Jan. 1st, 1925, amounted to no fewer than 21½ millions.

Probably no subject had attracted so much attention in this country in recent years as the exploitation of a smokeless fuel, and the recovery from coal of those valuable volatiles, which, in the ordinary way, were wasted; but despite more than a decade of intensive investigation into low-temperature methods no single process of treating British coals was yet proved on the large commercial scale; furthermore, the products of the operation, namely, semi-coke, primary tar and gas, had been produced only in relatively small quantities, and the values assigned to them might require very drastic revision.

If the combustion of house coal could be prohibited, and the 35 million tons replaced by the carbonised product of 50 million tons, some two or three hundred million gallons of gasoline would be available; a not unpleasing prospect in times of national emergency.

Of all the methods that had been proposed for converting solid fuel into liquid, that of Bergius stood out as a monument of laboratory research and brilliant engineering practice; but after many years of intensive effort the process had yet to justify itself commercially. The fact remained that Bergius had pointed the way to a more complete liquefaction of coal substance than had been deemed practicable.

Almost contemporaneously with the work of Bergius came the development of liquid products, not directly from coal but indirectly by way of water gas. In effect Franz Fischer and other investigators on the Continent had shown that the passage of water gas over a great variety of catalysts resulted in the formation of a complex mixture of alcohols and other bodies of the paraffin series which might be used as a motor fuel. It was stated that at the moment steps were being taken to put on the market very considerable quantities of his synthetic spirit. Work was being vigorously prosecuted, both in Germany and France, on this line of attack, and it did not seem at all unlikely that coal and its congeners might in future supply vast quantities of oils for internal-combustion engines.

The Electricity Supply Congress at Rome.

(By our Special Correspondent.)

The first congress of the Union Internationale des Producteurs et Distributeurs d'Energie Electrique was opened at Rome on the morning of September 21st. This organisation was formed in Paris recently to assist those interested in electricity supply. Among its objects are :—The creation of an information bureau for its members to supply periodically or from time to time the results of inquiries on special questions or to give information on experiences in different countries, including matters relating to tariffs, statistics and legislation. It encourages international arrangements relating to electricity supply and enters into relations with national and international organisations regarding technical, scientific and economic matters. It organises international congresses and publishes the proceedings in connection with them and also other documents regarding matters within the scope of the society's activities. And last, but not least, it encourages friendly relations between its members from different countries. When as the result of an offer made to the society through some of its Italian members, it was decided that the first congress should be held in Rome, the matter was taken up energetically and a local general committee and an executive sub-committee was formed, Senor Benito Mussolini, the Prime Minister, becoming its president, he being supported by the Italian Ministers of Finance, Public Works, Communications and National Economics with the Governor of Rome and a number of gentlemen well known in Italy for their activities in electrical matters, including Signor Guido Semenza, the President of the International Electrotechnical Commission.

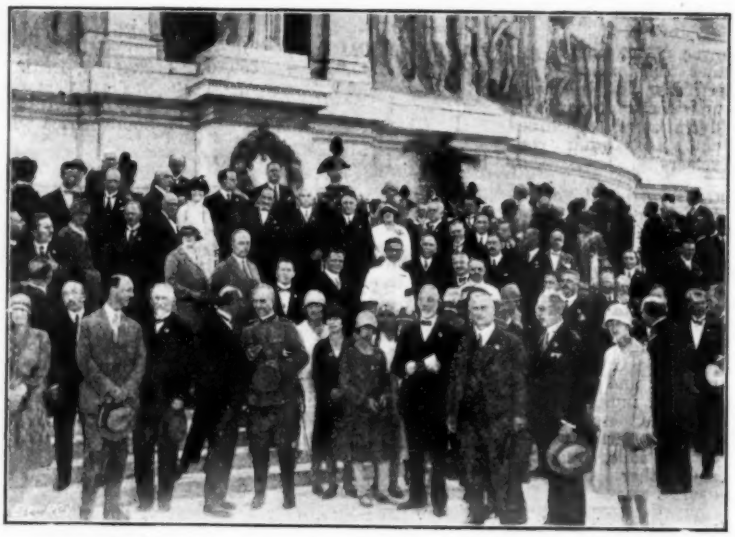
His Excellency Signor Filippo Cremonesi, the Governor of Rome, in opening the proceedings, said he was glad that Rome had been chosen for the first congress of the Society. Italy was proud of its position among the countries of the world for the way in which its water power had been harnessed and the presence of so many engineers was an agreeable recognition of that state of affairs. His countrymen were glad to show the visitors the way in which Italy, poor in primary materials and in the normal means of competition, had been able to utilise the energy available. The wonderful constructions recently erected were destined to show to future generations the great efforts of New Italy, under the leadership of Benito Mussolini, in the direction of economic power and scientific and artistic progress. He hoped the congress would have valuable scientific results.

Signor Gian Guiacomo Ponti, the President of the Executive of the Union of Producers of Electricity, welcomed his engineering colleagues from Europe and America; he welcomed Frenchmen, pointing out the work of Ampère; to those from Belgium he said that the school founded by Gerard had become renowned throughout the world; to those who came from England he would point out how much the world owed to Lord Kelvin, Faraday and Maxwell; he then instanced Oersted from Denmark, and the work of Brown, Boveri & Co., and the Oerlikon Co. centred in Switzerland. The total electrical power installed in the world exceeded 60 million h.p. Particulars were then given of the electric development in Italy, starting with a power station in Milan in 1883 with a capacity of 1,200 h.p. and a radius of 500 metres, then came the later station of Tivoli, with 26 km. transmission at 13,000 volts, the station at Paderno of 15,000 h.p. with a line 32 km. at 13,000 volts, down to such modern stations as Mont Cenis with the station at Venans, capable of giving 55,000 kW at 70,000 volts, utilising a fall of 1,100 metres, and the Tirso system in Sardinia, with its storage basin of 400 million cubic metres capacity. In 1898, the date when the Associazione Esercenti Imprese Elettriche (the Association of Electrical Supply Companies) was formed, the power installed in Italy was 87,000 h.p. Ten years later it became 426,000 h.p. In 1918, 1,240,000 h.p. was reached, and it is anticipated that by 1928 the figure will have reached 2,600,000 h.p. There are 1,200 central stations, of which 400 are of a material size, 45 stations having an individual output of 15,000 h.p. and upwards. On the side of power consumption the annual increase was about 12 per cent. In 1908 the consumption was 1,100 million kW-hours; in 1918, 4,000 millions; and in 1925, 7,050 millions. Of this last, 600 millions or 8.6 per cent. had been consumed as light, and 6,000 millions as motive power. The production was almost entirely hydraulic; in 1925 it was possible to save the importation of about 9 million tons of coal. The specific consumption per inhabitant was about 200 kW-hours per year. More than 7,000 out of 9,600 communes in Italy had been electrified. Apart from h.p. and l.p. distribution lines the length of transmission lines exceeded 45,000 km. (28,000 miles), of which 2,000 km. was for a pressure of over 100,000 volts.

Neglecting small enterprises, there were 185 companies with a capital exceeding 1 million lire, and if one took into account the securities, debentures, &c., the Italian electrical industry to-day represented 12,000 million lire of the national wealth.

M. Henri Cahen, President of the Association of French Producers of Electrical Energy, in the name of the visitors, thanked the King of Italy and the Royal Family and other authorities for the interest they had taken in the congress. He said that in the formation of the Union they had had the idea that in electrical supply matters they had a subject in which all nations could unite on a non-competitive basis; the idea had been taken up vigorously, and the number present at the congress, over 350, was a proof that their views had been soundly based. The utilisation of water power in Italy in the valley of the Po, with its interconnecting network which would shortly be connected up with water power in Central and Southern Italy, was something for a nation to be proud of. Many of those who had visited the Grenoble Exhibition last year had remarked on the admirable presentation made there by Italy. He felt very honoured that the Prime Minister had sent the Italian Minister of Public Works to the opening meeting as his representative, and that the Governor of Rome had opened the meeting. He had the honour to speak not merely on behalf of the foreign members of the congress, but also on behalf of those high officials of the French Ministries of Agriculture and Public Works, who had been sent specially to the congress by the French Government. The names of Ampère and Volta should form a link between the two nations, France and Italy.

Signor Guiriati, the Minister of Public Works, gave the assembly the welcome of the Prime Minister, and of the Italian Government. He said that the legislation connected with electricity was of a most liberal character and this had encouraged technical progress and the investment of capital; in 1925, in stations of 2 million kW capacity, over 700 million kWh had been produced, as the result of the happy relations existing between the State and private undertakings. The capital value of the national assets in hydraulic power had reached gigantic figures during the last few years, and the state of affairs enabled them to look forward to the future with tranquillity.



Some Members of the Congress in Rome at the Tomb of the Unknown Warrior.

The inaugural meeting took place in the historic buildings of the Capitol, in the old Roman basement arches of which, overlooking the wonderful ruins of the Forum, light refreshments were served.

Members of the congress then visited the Victor-Emanuel Memorial and laid a wreath on the tomb of the Unknown Warrior.

The first of the general meetings of the Rome congress took place on the afternoon of September 21st. The subjects discussed were "The Use of Pulverised Fuel" and, later, "The Use of High Temperatures and Pressures for Central Station Operations." The former report, which covered seventy quarto pages included an admirable summary prepared by M. Jean de Casanova, of Paris. The problem of the use of powdered fuel is much more complicated than would appear at first sight. The use of low-speed and high-speed pulverisers was dealt with, also the question of centralised and individual pulverisation. The use of high temperatures led to difficulties with furnace linings, and this had encouraged the use of water tube furnace walls, which had in turn had its effect, unless neutralised by special means, in reducing combustion tempera-

tures and combustion efficiency. The problem of turbulent combustion was explained.

During the course of the discussion of the reports on pulverised fuel, edited by M. de Casanova, Mr. G. Orrok, consulting engineer to the New York Edison Company, said that his company had adopted pulverised fuel for several reasons; it was possible to burn various kinds of coal without trouble, to obtain a larger boiler output, and thirdly, there was a material saving in labour costs. It could be said that when the coal was good the extra thermal efficiency with pulverised fuel was small, about 1 to 3 per cent.; when, however, the coal was bad, the savings were sufficient to justify the replacement of existing stokers by pulverised fuel plant. In New York City boilers were being installed of a capacity of 175,000 kg. of steam per hour, the overall efficiency anticipated being 85 per cent.; two boilers were large enough to run one 60,000-kW turbine. The saving in labour alone from the use of such big boilers in place of 3, 4, or 5 boilers per unit, would amount to $175,000 a year. If poorer quality coal was used in New York the economy would be much greater.

In the second paper, M. L. Hervy, director of the "Centrales Electriques de Flandres" company, gave particulars of experience with the use of extra high pressure at Langerbrugge, and gave theoretical notes regarding efficiencies obtained of 0.43 on the Carnot cycle, and of 0.42 on the Rankine cycle, the feed water being preheated to a high temperature in three stages with bled steam. The boiler used had a superheater close to the hottest part of the furnace. A high-pressure geared turbine of 1,750 kW was adopted, taking steam at 50 kg. per sq. cm. at a total temperature of 442 deg. C., discharging it at 20 kg. per sq. cm. at 330 deg. C. The steam then passed into a 6,600-kW turbine, and thence to a condenser. Over several days' test the h.p. turbine took 4.7 kg. of steam per kWh, after allowing for auxiliaries and the l.p. turbine 4.9 kg., with 0.513 kg. and 0.687 kg. of coal per kWh respectively, with coal of 7,000 calories per kg.; remarkable results for such a small output. With the report were given notes on the history of high pressures and on the development proceeding in Europe and America in this subject.

On the afternoon of September 22nd Mr. Lieb, of the New York Edison Company, "held the floor" for some time, giving notes on the extraordinary output and size of plant working in the United States, with lantern slides of some of the well-known water power stations.

Later a report was read on high-pressure cables, an interesting summary being by Prof. E. Soleri, of Turin. The question of paper and oils was touched upon, and the special high-pressure types of cable developed by Hochslaster, Emanueli, Silbermann and Soleri were described.

The "pros and cons" of the use of three single-phase cables, as against a three-core cable were brought out and the question of employing an earthed neutral was dealt with. M. Boissonnas, manager of the Société Générale de Force et Lumière, in the course of his paper, said his company had ordered in 1912 four km. of 45,000-volt, three-phase cable with cores of 75 sq. mm. area, and since that time a number of cables, three-phase and single-phase, had been in operation at 60,000 volts. It was not realised that cables designed for 150,000 volts direct current required no more insulation than one for 60,000 volts with the neutral point earthed. Between Moutiers and Lyons, where the Thury system is used, before long cables will be in operation with direct current at 150,000 volts to neutral and 300,000 volts between outers.

M. Marchand in his paper dealt with single and three-phase cables, cable laying and jointing and current density. A further paper was presented by Signor Palestrino, of Turin. These four papers on cables, aggregating 64 pages of text, like so many other papers presented at the Rome congress, merited much more discussion than time allowed.

Dealing with the subject of low-temperature carbonisation, and referring to papers on this matter by MM. R. Coureau and L. Hervy, M. J. Siegler, president of the Central Loire Electrical Association, said that it was an exceedingly difficult matter to make a low-temperature plant a paying proposition. There was a great variation in the market price of by-products, and the problem was to find means by which an economic balance could be obtained, that was to say, by which the economic circle could be joined up. A small variation in the market price of by-products might make a great difference in the economic results of a plant. If it was desired to sell it and the gas produced was of a higher calorific value than that supplied by the normal gas company, one difficulty was to find a suitable diluting medium without increasing the percentage content of water gas beyond the limits allowed by different local authorities. The cost of the plant required varied from 3,000 fr. to 12,000 fr. (gold) (£120 to £480) per ton of coal treated per day. Great difficulties had taken place, under some conditions through an excess of dust, which tended to reduce the value of the tar and other by-products. In the opinion of M. Casanova it was not economically sound to take up a process which did not justify itself on its own basis, using as an excuse for such a policy that possible improvements in some entirely different business (for instance, in the distillation of by-products) might be made, so as to make good the gap in the economic circle. So far as the use of such processes by electricity producers was concerned, at present there were very few attractions, although there was one opening for the use of the gas produced, and that was under boilers at moderate temperatures, with final air-heaters but no economisers.

(To be continued.)

Electricity in South India.

(From Our Indian Correspondent.)

In an address on "Electrical Developments in South India, Past, Present and Future," Prof. Catterson Smith, President of the Electrical Engineering Society, Indian Institute of Science, Bangalore, referred to two past developments which he regarded as marking the commencement of progress in this respect, namely, the Cauvery power scheme, with its great station at Sivasamudram and transmission lines to the Kolar Gold Fields, Bangalore and Mysore, and the Indian Institute of Science at Bangalore, with its splendid laboratories for the study of many branches of electrical engineering.

The present developments may be said to include the extension of the Cauvery power scheme, the installation of electrical machinery of the most modern types at Kolar Gold Fields, and the successful operation of the high-speed automatic wireless telegraph station belonging to the Government of India and situated at Fort Madras.

With regard to the future, the President remarked that most important developments would be those arising out of the electrical schemes of the Government of Madras to utilise the water power now running to waste throughout the Presidency. Of the four divisions examined and reported upon by Mr. S. G. Forbes, Chief Electrical Engineer to the Mysore State, amongst others, the most important as a starting point was the Madras-Nilgiris project. The proposals submitted to the consulting engineers were for a 40,000-h.p. (continuous rating) station comprising two power houses, one at the foot of the falls at Pykara, and the other about 12 miles distant on the Moyar River. The technical aspects of the scheme were referred to, and the President expressed the hope that before a decision on so costly an undertaking was arrived at, the initial capital cost amounting to about three million pounds sterling, full consideration should be given to the difficulties which might be met with. The transmission of this power as three-phase alternating current at 50 cycles per second was open to criticism on account of the length of the line, *viz.*, 350 miles, and the enormous charging current involved.

Even the use of 25 cycles, as in the Mysore network, left much to be desired in this respect. The possibility of using direct current must not be ignored, and the President reminded his audience that those matters were under consideration elsewhere, citing, for instance, the proposals for generating power in Norway and transmitting it to Denmark. The scheme bore a close resemblance to the Presidency requirements, the shortest distance, including under-sea cables, being 350 miles, as in Madras, and the number of receiving stations proposed being about the same.

High-pressure direct-current schemes were not new, and were to be found in several countries; even in London there was the Metropolitan 100,000-volt direct-current transmission. Recent developments all went to show the reasonable possibilities of direct-current transmission. Alternating-current transmission owed much of its success to the reliability of the oil-immersed high-pressure transformer. The direct-current counterpart of the transformer was to be found in either the "Transverter," developed by Highfield and Calverley for the English Electric Company, or the most recent types of thermionic valve converters, both these types being suitable for 100,000 volts, direct current, or even higher voltages.

The over-all cost of the installation was probably about the same for either direct- or alternating-current systems, but the former was free from the serious drawback of charging current on a long line, such as was proposed for the Madras scheme. This required as much as 25,000 kVA of station plant to be kept running to charge the lines at 50 cycles for one line only, and this no one was likely to accept as a sound proposition.

Prof. Catterson Smith then referred to the vision of the future which the electrical engineer could not fail to see in the growing possibility of transmission without wires. The radio transmission of beams was fast developing, and eventually concentrated energy beams, similar to beams of light, would be used to transfer electrical energy from the water-power station to its receiving station. The means for this were at hand, but practical difficulties existed which would have to be overcome.

Modernising Vienna's Fire Brigade Equipment.—For some years a number of battery-equipped electric vehicles have been used by the fire brigade authorities of Vienna for the conveyance of firemen to the scene of a fire. With the steady extension of the city limits it has been found that battery vehicles no longer fully meet the requirements, and instead of replacing the old vehicles it was decided to convert them to petrol-electric propulsion. The vehicles are driven by motors combined with the hubs on the front wheels, and these are retained in the modernised machines. The work of conversion was entrusted to the Oesterreichische Automobil-fabrik Gesellschaft of Vienna, which slightly lengthened the chassis members at the front end in order to accommodate a 36-h.p. four-cylinder engine, which is coupled to a Brown-Boveri dynamo. The work of conversion of the Vienna vehicles has proved so successful that, we understand, the fire-brigade authorities of Berlin have decided to follow the example.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Lightning Rod Act in Ontario, Canada.

The abstract by Mr. K. Hedges of the regulations ratified by law in Ontario for the installation of lightning protection systems should be of particular interest to our Home Office authorities, in view of the ever-increasing risks unwittingly taken by householders in this country in connection with wireless aerials.

Mr. Hedges makes no comment on the details of the regulations, but there is one clause which is certainly debatable, and possibly founded on an erroneous concept, *viz.*: "The earth terminals have been carried to the full depth required by the regulations." This clause implies that the deeper the earth terminal, the greater is the measure of protection afforded, and that a certain specified minimum depth is imperative to neutralise successfully an average flash without external disruption at the earth terminal.

In the farmhouse example illustrated, three paths are shown to earth, but there is no complaint that the earth connections were insufficiently deep to meet the requirements of the regulations, and though probably none of them would be as deep as the regulations demand, yet there is no mention of disruption of the earth in the vicinity of the water feed pipes.

Prior to a flash occurring, the electrified cloud is subtended by an opposite charge on the ground, the intensity of various local parts of the field of which is greater the nearer it is to the cloud, the better its conductivity, and the greater its capacity. Given a plane conducting ground surface, the earth charge would have a contour similar to that of the cloud, and an intensity varying directly with the intensity of the charge of that portion of the cloud immediately above it. The actual surface of the ground would show the greatest intensity of field, which intensity would decrease as the depth or distance from the surface increased.

It follows, therefore, that a lightning rod which passes vertically downward to an infinite depth in the earth presents the minimum area of contact for the release of a charge which is strongest at the surface, and tends to set up undesirable oscillations. The greatest conduction and maximum damping would be obtained by securing the greatest area of contact with the surface of the ground; this is attained by leading the conductor away from the building to be protected at a distance of, say, one foot below the surface in order to obtain a lower contact resistance than is possible on the actual surface, and to render the conductor immune from interference.

E. Isherwood.

Saltcoats, *September 21st*, 1926.

Cooking by Thermal Storage.

Referring to your leading article under the above heading in your issue of the 17th, and also to Mr. Borlase Matthews's article, you may be interested to hear that my attention was drawn to the "Seves" cooker more than two years ago.

I obtained a sample and demonstrated it to several central station engineers who were particularly interested in domestic cooking, so as to obtain an unbiased opinion as to the prospects of such a cooker in this country.

Although the principle was very interesting, we had to come to the conclusion that the cooking methods possible with this type of cooker would not appeal to the British housewife, principally owing to the fact that cooking is only possible on one small surface and that proper roasting facilities are not available.

T. Settley,
Manager of Heating and Cooking Dept.
The General Electric Co., Ltd.

London, *September 21st*, 1926.

[Mr. Settley's comments are very interesting and to the point. We understand that the "Seves" cooker is more particularly suitable for country dwellers, and that on the Continent much less use is made of the roasting and grilling processes than in this country; but when facilities are required for these purposes, a separate electric oven and grill are provided, to which the current is diverted from the thermal-storage cooker, so that the maximum demand is not increased. Alternatively, the wood-fired oven which is found in most Swedish houses can be used for roasting and baking.—Eds. Elec. Rev.]

Relief Bolts and Flameproof Enclosures.

In an article in your issue of September 24th, Mr. P. Huggins extols the use of certain forms of protection of apparatus for use in fiery mines to the extent of nearly three pages, and then proceeds to dismiss other known and approved methods in a couple of paragraphs. It seems desirable, therefore, to examine, a little more closely, the grounds for sweeping them aside.

The particular form of protection with which I am familiar is known as the "relief bolt," and I will therefore confine my remarks to this.

Relief bolts can be applied to any cover having suitable machined flanges. They consist of a shouldered bolt under the head of which there is a spring enclosed in a brass casing; the latter being secured to the bolt so that the components cannot be separated. In the early stages it was necessary to tighten the bolt with care, so as not to screw it quite home and thus prevent relief. The present design has eliminated this disadvantage, and the bolt is applied and screwed home just like an ordinary bolt.

In the event of an internal explosion, or rise of pressure, the cover of an enclosure fitted with relief bolts is allowed to lift, and the hot gases are cooled in the process of their expulsion between the flanges of the enclosure. The advantages of the system are:—

1. Any enclosure of adequate strength, having suitable machined flanges, can be made flame-proof by the simple process of using relief bolts.
2. Neither before nor after an explosion is there any permanent gap which would allow dirt or grit to be drawn into the enclosure through the heating and cooling of the air inside. It is usual not to machine the faces of the flanges dead smooth, so that there is no question of a vacuum being attained inside.

Enclosures fitted with relief bolts have been tested by the appropriate authority on many occasions, and have been proved to function satisfactorily and to keep down the pressure due to an explosion within safe limits.

The definite point mentioned by Mr. Huggins against the system is that "the inertia of the cover prevents its action being sufficiently rapid to provide the maximum pressure release. . . ."

The answer to this is that the inertia of the cover does not prevent rapid action or efficient relief. The point is purely theoretical, and has no practical bearing on the problem.

Unless Mr. Huggins can demonstrate that the inertia of the cover does in fact prevent sufficiently rapid action it is useless to drag in the subject of inertia, and it might be as well for him to set out a few of the unspecified "many reasons" against the relief bolt system.

R. Amberton.

London, *September 25th*, 1926.

Engineering Specifications and their Writers.

The article in your current issue should bring gladness to the hearts of not a few of your readers. Not that it raises hopes of betterment, but rather that it voices sentiments and feelings—the pent-up feelings, maybe—of a working lifetime.

If the consulting engineer is not exactly what we should like him to be, we must not forget that he is what we have made him. He is a pampered product of the time, and as we have put the whip into his hand, we ought not to squeal under the lash.

His specifications—many of them—are truly stupendous. They are compiled ostensibly for the guidance of tenderers, but reveal only too clearly the workings of the subconscious mind (excuse the expression) towards a threefold endeavour: first, to impress the client and justify the fee; secondly, to collect valuable data for future use and profit; and, thirdly, to impress the tenderer with the standing of the client who can afford to spend so much on professional advice and (speak softly!) to get so little of it in return.

Incidentally, the client is both satisfied and gratified; satisfied that he is getting quite a lot for his money in the way of advice, and gratified at figuring so prominently throughout the printed pages of a document of quite encyclopædic proportions. Left to his own unenlightened self, the client might have thought the whole business could be dealt with on a half-sheet of notepaper, and maybe he would not have been very far wrong.

In inviting tenders, why should the ninety-and-nine be peremptorily called upon to pierce a dense forest of detail—rank undergrowth, to be cleared before progress can be made—and to furnish "free for nothing *gratis*" a mass of information which can only be asked for legitimately from the hundredth man—after he has got the job, and even not then if it is something not bargained for when tendering?

It would be interesting to know how Henry Ford would deal with these gentlemen. One imagines that consultants do not loom very large in his scheme of things.

The gentlemen who indulge in these unwieldy specifications are very familiar with the words "estimates free" and the familiarity may have bred contempt. From youth upwards these two words have caught the eye—seen most frequently in capital letters on the sides of big furniture removal vans. The association has stuck fast in these men's "minds," and it has not yet dawned upon them that the estimating on a job of decent magnitude—say, a super-power station for the solar system, or such like undertaking—may be a rather more costly matter than estimating for the removal of the "sticks" from a three-roomed flat to another one just round the corner.

The old adage: "one half the world knows not how the other half lives" comes into mind, and prompts one to say that considerably more than one half of that very exclusive world which has the ordering of things to be done has not the faintest idea of what it means to do them.

To a great extent we must blame our competitive system, which makes the buyer always "top-dog," and the seller the "toady."

Some day perhaps our mighty captains of industry, with their powerful organisations and combines, will revolt against the tyranny of the "top-dog." They will tell consulting engineers and others, and municipal councils, aye, and (say it with

bated breath!) even Government departments, that if they want these fantastic and costly tenders they can have them—if they will pay for them.

Utopia in sight! Who knows?

A Fellow Sufferer.

Birmingham, *September 25th*, 1926.

The Importance of Making a Supply of Electricity Available.

With reference to your admirable leader on the autumn campaign to popularise the use of electricity, this would be greatly facilitated if only the supply authorities would really help in the matter, and lay mains in the areas where many potential consumers live. This especially applies to suburbs in which houses have been erected some number of years; if a supply were available customers would to-day need little persuasion to make use of it.

It seems wrong that a supply company should have the monopoly of supply and not provide it; it would be well to follow the gas interests in the matter of availability of supply.

F. Goble, A.M.I.E.E.

London, *September 25th*, 1926.

Current from the Mains.

Visiting the recent Radio Exhibition at Olympia, one observed that there is a tendency to introduce apparatus for the elimination of batteries—in other words, to take current from the electric lighting mains to use for wireless sets. Most of the apparatus exhibited for this purpose would, to my mind, be unsafe to connect to the electric light mains, and it would appear that the designers have very little knowledge of regulations which control any apparatus that is for connection at such voltages as we use in our homes. I think a note of warning should be given, and no apparatus should be allowed to be connected whose design does not comply with the regulations which exist for the protection of the public.

There was only one design at the Exhibition in which, seemingly, the designers had in mind the above point of view.

A. W. Prangnell.

Acton, *September 24th*, 1926.

[It is certainly most desirable that every care within reason be taken to ensure safety to person and property; but to what "regulations" does our correspondent allude?—Eds. Elec. Rev.]

Legal.

Alleged Assault on Tramway Manager.

A remand until October 13th, bail being allowed, was granted at Darwen, on September 22nd, in the case in which James E. Topping, blacksmith, Blackburn, is charged with maliciously inflicting grievous bodily harm upon Mr. G. A. Newsome, the Darwen Corporation tramway manager, by striking him. A scene occurred in the tramway depôt, on August 31st, and the manager had his upper jaw fractured.

Charge under the Bankruptcy Acts.

At the Birmingham Police Court on Tuesday, September 21st, before the Deputy-Stipendiary (Mr. J. S. Pritchett), Albert O'Hara Bradshaw (30), described as a merchant, of no fixed abode, was committed for trial to the Quarter Sessions (bail being allowed), on charges in connection with the Bankruptcy Act and the disposal of certain of his assets. Mr. Pugh, solicitor for the prosecution, stated that the charges against Bradshaw were twofold. He was adjudged bankrupt on August 21st, 1923, and the first charge was that within six months before the presentation of the petition by him he unlawfully, and with intent to defraud, disposed of certain property which he had obtained on credit. This included 1,000 electric lamps from the General Electric Co., Ltd., 960 lamps obtained from the same company, a quantity of head-'phones worth £372, and a further quantity of head-'phones valued at £383. These constituted separate transactions. The second charge was one of obtaining these goods by false pretences within six months of the presentation of his petition. When Bradshaw presented his petition in 1923, he scheduled his assets at £870, but they subsequently realised about £200. The liabilities amounted to about £12,000. The goods which were the subject of the charges were bought by the accused and sold the same day at prices which were very low. He gave cheques for the sums involved, but these were dishonoured by the bank. Mr. Frederick Boyes, of the General Electric Co., Ltd., said that on July 25th, 1923, defendant called on him and said he wanted to buy some lamps. As there was an account outstanding against Bradshaw of £72, witness told defendant that he would have to settle this account first. Defendant then gave him a cheque for that amount, and also one for £163 to cover the order. A further cheque for goods supplied for £259 was also paid by defendant on July 26th. All these cheques were returned marked "refer to drawer." The money had not been paid for these goods. Henry John Webb, Walsall, proprietor of the Mechanical and Engineering Co., said defendant called upon him early in 1923, and wanted to purchase wireless material and head-'phones. He was supplied with goods by witness, who proved a debt of £333 in the bankruptcy proceedings. There was now a balance of £83, defendant's father having paid a certain amount after the bankruptcy proceedings. Mr George Hunt, Birmingham, a director of the Forum Co., said he was the proprietor of the business in 1923, and he purchased, during that year, from the defendant, wireless accessories to the extent of £15,000. He did not buy goods at less than the normal price.

Reviews.

Power Factor Wastes. By C. R. Underhill. Pp. xiii+326; figs. 117. London: McGraw-Hill Publishing Co., Ltd. Price 17s. 6d. net.

The subject of power factor, and of the losses entailed in the commercial uses of electrical energy in connection therewith, has been much discussed and written about during the past decade or more, and it still remains a "live" problem, with many possibilities as one of the principal sources of improvement in the efficiency of modern electric transmission systems. Publications on the matter have been largely of a diffuse and scattered character, and one of the purposes this volume serves is to form a concise nucleus of the subject; it presents at the same time the views, from many angles, of the various parties interested, both from the theoretical and practical standpoints, *e.g.*, members of electric supply organisations, designers, distribution authorities, and users of electrical energy, large and small.

The book is entirely American in its outlook; all experience and examples are drawn from the practice of the U.S.A., where large scale and varied experiments have been made, and the information contained in it will be most useful to those interested, whatever their locality.

In the theoretical portions, mathematical treatment is reduced to a minimum, but this is not a prominent feature of the work, which is very decidedly marked by its commercial aspect throughout. The text, in addition to the original material from the author's pen, is a compilation of the opinions and experiences of various well-known American authorities.

A copious index serves as a useful guide to the reading matter, conveniently divided into 20 chapters comprising 129 articles.

The introduction explains the operating principles of alternating-current motors and power factor in a simple popular fashion, and refers to the Fynn-Weichsel motor, which is defined as a combination induction and synchronous motor with the exciter built into it.

It is remarked that the low-speed induction motor, with about 80 per cent. power factor at full, to 60 per cent. at half load, is more responsible for the low power factors of many systems, than the high-speed induction motor, which often has 90 per cent. and 80 per cent. power factor, at full and half loads, respectively.

In chapter II, article 11, the metaphor brought in to explain reactance is strained to inaccuracy, *viz.*: "The energy of the running or working current . . . keeps going forward to do useful work while the energy of the magnetising current magnetises induction motors and other apparatus and then is exhausted back into the line." This could be revised with advantage, as it gives the idea that energy is returned to the line, and this is erroneous. Again, three lines further, "No energy is lost, except that due to the friction of the electricity with the structures of the copper conductors," does not seem to convey the author's meaning; if he refers to heating loss due to the current, that is quite a different thing, having nothing to do with friction in the usual sense. The word electricity is loosely used when speaking of the rate of flow of electrical energy in such phrases as "the faster the electricity flows."

The importance of designing the lay-out to ensure a motor of the most suitable horse-power being installed for each drive is properly emphasised as a prime factor in obtaining high power factor, owing to the close relationship between load factor and power factor.

One chapter is devoted to a very useful symposium of the opinions and experiences of some well-known authorities of electric supply companies as to the actual effect of power factor correction in their systems; including discussion of the location of the correcting equipment, rating systems adopted, and the possibilities of more general application than at present is customary.

The fundamental principles of power factor correction are set out and illustrated with curves and vector diagrams, also the characteristics of induction motors are effectively described. Next, these principles are applied to induction motors, with the necessary mathematical treatment. The use of synchronous machinery is well exemplified by the description of some typical instances, *e.g.*, a 500-h.p. synchronous motor in a cement mill, requiring 150 per cent. full-load torque for

starting. This motor is coupled through a magnetic clutch, which can be brought into action gradually, increasing the load on the motor for a period of six seconds. Data are presented with regard to synchronous condensers, and there is a table of the results of power factor correction in the cases of customers of the Duquesne Light Co. showing the average power factor for 18 firms, varying between 91.1 and 93.7 per cent. taken over monthly periods for 10 months. One customer's annual account is analysed, for a plant of 11,500 h.p. motor capacity, and a condenser of 5,000 kVA, costing $30,000. The annual saving, after correction, is $40,710.

Interesting details are given of the re-arrangement of some group-drive installations, resulting in the increase of plant power factor from 60 per cent. to 75 per cent., and the financial results are shown.

Details of tests with induction motors with a view to estimating the required capacity of a synchronous motor to give a definite power factor improvement are scheduled, and losses are compared.

Curves are plotted to show the relationship between power factor and load, for synchronous motors at constant excitation, and other useful curves are given.

Static condensers are thoroughly treated of in chapter XII as to principles of action, details of construction, methods of connecting up and calculations. The following chapter deals with their application to individual motors, being contributed by P. B. Vallé; and chapter XIV, on the general use of capacitors, as static condensers for this purpose are called, is written by R. H. Carlton.

Power factor correction by Fynn-Weichsel motors is described by E. W. Goldschmidt, with many illustrations of connections, curves of speed-torque characteristics, and resultant savings.

Chapter XIX contains statistical data from electric supply companies as to methods of determining power factor and the giving of bonuses, discounts, and penalties. The last chapter is a summary of the work, with general conclusions and a table showing the distribution of industrial load in the United States in January, 1924.

This book will be a useful addition to the library of anyone interested in the commercial working of alternating-current systems.

W. N. Y. King.

Elements of Electricity. By Wm. H. Timbie. Second edition. Pp. 624; 428 figs. New York: John Wiley & Sons. Price 17s. 6d. net.

The first edition of Timbie's "Elements of Electricity" was published in 1910 and this, together with his other works on the industrial applications of electricity, has gained for the author a well-deserved reputation as a writer of electrical textbooks.

The present revision has enabled Professor Timbie to include new chapters on the electron theory, the vacuum tube, and the electrostatic circuit, as well as to bring up to date the chapters which appeared in his earlier text. The volume now constitutes a very complete and readable treatise which should serve as a suitable textbook for students attending classes in applied electricity up to and a little beyond the standard of the First National Certificate.

Apart from the thoroughness with which the whole of the ground is covered and the practical nature of the explanations, the most striking feature of the book is the number of examples. In the direct-current section there are no fewer than 532, about half of which are worked, and in the alternating-current section there are 289. This indicates quite clearly that the author expects some hard work from his readers, and it is certainly not a textbook to be recommended to the feet-on-the-mantelpiece variety of student.

Although the book loses a little of its value to the English electrical student on account of its constant reference to American practice, it cannot fail to prove a valuable auxiliary textbook both to students and teachers in this country, especially by virtue of its wealth of worked and unworked examples.

P.H.S.K.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 22nd:—

Voltron (lettering and design). No. 470,451. Class 8. Apparatus for use in wireless telegraphy and telephony.—Kenneth Macpherson, trading as the Voltron Co., 75, City Road, London, E.C.1.

Motacynes. No. 471,355. Class 8. Apparatus and devices for advertising, *viz.*, projectors, automatic time switches, switchboards, &c.—Shinichi Hamaguchi, 54, Gracechurch Street, London, E.C.3.

Chello. No. 471,780. Class 8. Apparatus for use in wireless telephony.—Climax Radio Electric, Ltd., Quill Works, Quill Lane, Putney, S.W.15.

In Lux Way (lettering and design). No. 456,313. Class 13. Electric lamps for motor cars and cycles, shade covers for electric lamps, electric hand lamps, switches, terminals, and electrical fittings, all being for use on motor-cars and cycles.—Samuel Heath & Sons, Ltd., Cobden Works, Leopold Street, Birmingham.

Insulon. No. 472,284. Class 40. Goods manufactured from india-rubber and gutta-percha.—Thomas de la Rue & Co., Ltd., 10, Bunhill Row, London, E.C.1.

Published Specifications.

Compiled expressly for this journal by patent agents. The name of the applicant's patent agent, if any, will be found on the printed specification. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

8,494. "Apparatus for indicating acoustically the depth of water under a ship, or the like." F. E. Smith, B. S. Smith, and H. F. Bellars. March 30th, 1925. (257,638.)

8,628. "Acoustic amplifiers and radiators suitable for use with loud-speaking telephonic receivers and other sound producing or reproducing apparatus." E. A. Graham (deceased). March 31st, 1925. (257,639.)

10,911. "Manufacture of artificial filaments." G. B. Ellis (Soc. pour la Fabrication de Soie-Rhodiaseta). April 27th, 1925. (Convention date not granted.) (248,696.)

11,576. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), A. M. Searle, J. H. E. Baker, and W. R. Moscrip. May 4th, 1925. (257,645.)

11,793. "Telephone instruments and the like." F. C. Doble. May 6th, 1925. (257,647.)

13,745. "Acoustical apparatus, particularly for converting the sound impressions of gramophone or like records into corresponding electric oscillations." British Thomson-Houston Co., Ltd., J. H. Butcher, and F. P. Wills. May 28th, 1925. (257,651.)

14,485. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). June 4th, 1925. (Patent of addition not granted.) (257,661.)

14,493. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. June 4th, 1925. (257,662.)

14,559. "Electrical condenser." S. Fisher and W. E. F. Fitzgerald. June 4th, 1925. (257,669.)

14,576. "Electric relays." M. Fiachetti. June 4th, 1924. (235,204.)

14,667. "Electric regulators." British Thomson-Houston Co., Ltd., and R. D. Parry. June 5th, 1925. (Cognate application, 32,436/25.) (257,675.)

14,724. "Indicator for marking the different tuning-in positions of various wireless broadcasting stations." H. V. Flinn. June 6th, 1925. (257,679.)

15,007. "Thermionic valves." General Electric Co., Ltd., and A. C. Bartlett. June 9th, 1925. (257,683.)

15,134. "Automatic telephone systems." Siemens Bros. & Co., Ltd., J. Berry, and W. G. Patterson. June 10th, 1925. (257,685.)

15,674. "Electrical treatment of atmospheric air." D. F. Sargent, A. A. Legat, and G. R. Wittleton. June 17th, 1925. (257,694.)

15,689. "Means for transforming and/or converting electric current." E. Diodato. June 17th, 1925. (257,695.)

16,537. "Electric protective arrangement." British Thomson-Houston Co., Ltd., H. S. Petch, and E. L. E. Wheatcroft. June 26th, 1925. (257,699.)

17,266. "Electric lanterns." J. Eaton. July 6th, 1925. (257,705.)

17,639. "Thermionic valve circuits." Igranic Electric Co., Ltd., and P. W. Willans. July 9th, 1925. (Cognate application 1,656/26.) (257,708.)

17,878. "Arrangement and construction of the windings of electric transformers." English Electric Co., Ltd., and R. M. Charley. July 13th, 1925. (257,709.)

18,033. "Transformers for alternating-current electric arc welding apparatus." F. C. Owen. July 14th, 1925. (257,710.)

19,049. "Rheostats for use in radio apparatus." Igranic Electric Co., Ltd., A. H. Curtis, and G. F. Dandridge. July 27th, 1925. (257,713.)

20,279. "Horns for gramophones, loud-speakers, and like sound-producing apparatus." C. H. Biggs. August 12th, 1925. (257,725.)

20,921. "Electric hearing apparatus for deaf persons." Siemens & Halske Akt.-Ges. August 20th, 1924. (236,890.)

21,290. "Electric elevator systems." Waygood-Otis, Ltd. February 3rd, 1925. (247,145.)

23,330. "Loud-speaking telephones." S. G. Brown. September 18th, 1925. (257,747.)

23,673. "Electric resistances." English Electric Co., Ltd., and H. H. Andrews. September 22nd, 1925. (257,751.)

23,800. "Manufacture of insulated staples." D. S. Salisbury (executrix of S. S. Walker, deceased). September 24th, 1925. (257,753.)

26,476. "Multiplex carrier-wave signalling systems." Standard Telephones and Cables, Ltd (formerly Western Electric Co., Ltd.) (Bell Telephone Laboratories, Inc.) October 22nd, 1925. (257,769.)

27,220. "Battery lantern." National Carbon Co., Inc. March 3rd, 1925. (248,703.)

28,553. "Electrical water-heaters." E. C. R Marks (G. A. Walker, *née* Honey). November 12th, 1925. (257,781.)

1926.

536. "Method of and apparatus for multiplex signalling." Marconi's Wireless Telegraph Co., Ltd. January 8th, 1925. (245,782.)

3,043. "Electric elevator systems." Waygood-Otis, Ltd. May 13th, 1925. (252,122.)

4,678. "Anodes for production of organic acids." F. Tallada. February 18th, 1926. (257,826.)

6,696. "Electric arc lamps." E. Steinberg. June 12th, 1925. (Divided application on 251,129.) (257,833.)

11,073. "Holders for electrodes employed in electric-arc welding." Consolidated Pneumatic Tool Co., Ltd., and V. J. Keith. April 27th, 1926. (257,858.)

11,295. "Protective means for the circuit of electric lighting tubes for high-voltage current." Akt.-Ges. für Elektrizitats-Industrie. June 13th, 1925. (253,493.)

11,612. "Indicators of the action of series of spark plugs of internal-combustion engines." M. Heffernan. May 3rd, 1926. (257,861.)

12,445. "Electromagnetic switches." General Electric Co., Ltd., H. C. Turner, and A. Sherwin. May 14th, 1926. (257,862.)

13,045. "Machines for the manufacture of electric incandescent lamps and similar articles." British Thomson-Houston Co., Ltd. May 23rd, 1925. (252,395.)

13,230. "Means for obviating interferences and disturbances in wireless telegraphy and telephony." Telefunken Ges. für Drahtlose Telegraphie. May 23rd, 1925. (252,409.)

13,770. "Treatment or manufacture of incandescent bodies of glow lamps, X-ray tubes, and the like." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 4th, 1925. (253,106.)

14,433. "Electric lamps." H. M. Edmonds. December 8th, 1925. (257,867.)

16,687. "Spark-plugs for internal-combustion engines." H. Fisher. July 2nd, 1925. (Addition to 244,090.) (254,745.)

17,902. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. June 4th, 1926. (Divided application on 257,662.) (257,873.)